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NED-2 Reference Guide

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Abstract

This is the reference guide for NED-2, which is the latest version of NED, a forest ecosystem management decision support system. This software is part of a family of software products intended to help resource managers develop goals, assess current and future conditions, and produce sustainable management plans for forest properties. Designed for stand-alone Windows-based personal computers, NED-2 integrates a variety of forest management tools into a single environment. These tools include databases, growth and yield models, wildlife models, geographic information systems (GIS), visualization tools, and others. The software is distributed with an online help system and a user's guide. This reference guide provides more detailed explanations of the models, equations, and rules that underlie the software. NED-2 software can be downloaded from http://www.nrs.fs.fed.us/tools/ned/products/ned2/

Cover Photo

Dukes Experimental Forest, Marquette, MI. Photo by Mark J. Twery, U.S. Forest Service.

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NED Contributors

The list of contributors for NED-2 is large and includes members from state and federal agencies, universities, and private industry. The list includes practicing foresters, wildlife biologists, landscape architects, hydrologists, and more. Development of NED-2 began with the formation of the following core team that consisted of representatives from each of several resource committees, as well as, several software developers. The original core team met two to three times annually to work out the details of NED-2.

Original NED core team members included the following:

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Early contributors to the NED development project also included the following:

David A. Marquis, Research Silviculturist, Northeastern Research Station, Retired. We are most indebted for his vision and energy that conceived the project and sustained its early development.

Clay Smith, Research Silviculturist, Northeastern Research Station, Deceased.

Laura Alban, Forester, SUNY College of Environmental Sciences and Forestry.

Tom Schuler, Research Forester, Northern Research Station.

Brian Simpson, Forester, Northern Research Station.

Max McFadden, Assistant Director, Northeastern Research Station, Retired.

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NED-2 Resource Committees

Early in the development of NED-2, many scientific and managerial concepts were incorporated into NED-2 as a result of input from several resource committees. Prior to 1998, committees provided guidance on desired resource conditions, rules and regulations, operational procedures, definitions, and other concepts based on scientific research and professional practice.

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Committee members: Daniel Brauning, Daniel Devlin, Donald Gibbon, Emily Grafton, Katharine Hakala, Tina Hall, James Kotcon, Larry Master, James McGraw, John McKown, Rose Marie Muzika, Charles Smith, Steve Sutherland, Gary Wade, Paul Weigman, Mary Hoffman, Jeff Knoop, Craig Martin, and Nancy Putnam

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Landscape ecology

Committee chairs: Eric Gustafson and Swee May Tang

Social ecology

Committee chair: Morgan Grove

Committee members: William R. Burch, Jr., Kenneth Cordell, Thomas Duffus, Shawn Dalton, Marla Emery, Tim Foresman, Marilyn Hoskins, Lloyd Irland, Pamela Jakes, Jerilyn Levi, Bernie Lewis, Gary E. Machlis, Max McFadden, Jean McKendry, Rob Northrop, Elinor Ostrom, James Palmer, J. Kathy Parker, Brian Payne, Steward Pickett, Mike Rechlin, Dianne Rocheleau, and James Thorne

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Committee chairs: Jim Palmer, Robin Hoffman

Present committee members: Skip Echelberger, Paul Gobster, Steve Hollenhorst, Gary Kell, William Kerr, Tom Kokx, Tom More, Peggy Pings, and Bruce Reid

Previous committee members: Mary Anna Harrilchak and John Kuhr

Water

Committee chair: Jim Hornbeck

Committee members: Mary Beth Adams, Edward Corbett, Tony Federer, Donald Hair, James Kochenderfer, Harry Parrott, Doug Ryan, Robert Smith, and James Vose

Wildlife

Committee chair: Dave deCalesta (Linda Thomasma 1992 to 1995)

Committee members: Doug Blodgett, Robert Brooks, Alan Boss, Richard DeGraaf, Clayton Grove, William Healy, John Lanier, Brad Nelson, Ralph Nyland, Steve Pelletier, William Porter, Robert Szaro, and Mariko Yamasaki

Chapter 1 - Introduction

This is the reference guide for NED-2. It is a companion volume to the NED-2 User's Guide (Twery et al. 2011), which provides an introduction to the program and general instructions for its use. In this guide you will find descriptions of the entire set of resource goals, data variables, and outputs available in NED-2. This guide also provides an overview of forest silvicultural systems and recommended silvicultural approaches for major forest types in the northeastern United States. The NED-2 software and documentation, including this reference guide, sample field tally sheets, and other supporting materials, can be downloaded without charge from the Northern Research Station's web site at http://nrs.fs.fed.us/tools/ned/products/ned2/.

ABOUT NED SOFTWARE

NED-2 is the latest version of NED, a forest ecosystem management decision support system that is part of a family of software products intended to help resource managers develop goals, assess current and future conditions, and produce sustainable management plans for forest properties. NED originally was an acronym for the Northeast Decision Model but as the geographical scope of the project expanded, the software lost the regional reference in its name and has become simply NED.

The NED concept is to use an original prescription design system to incorporate management goals for multiple objectives, analyze current forest conditions, recommend management alternatives, and predict future conditions under different alternatives. NED is designed to include a long-term, landscape-level view of the forest as an interconnected ecosystem that is too complex to understand at every level but which still must be managed. Recommendations for potential treatments involve information on all resources affected and provide options from which a manager may choose. The technique involves defining a management area of interest, defining goals for the area, identifying conditions necessary to meet each goal, and identifying conditions that can be met in conjunction with others, from most restrictive to least restrictive.

The process begins with the selection of management objectives, or goals, for any or all of five resources: visual quality, wildlife, water, wood production, and general ecological objectives. These goals are defined for a management unit at a scale from one to many stands, generally within the range of 5 to 5,000 hectares. Committees of experts in each of the specific resources have defined the conditions necessary to meet the specified goals, and have determined common variables to allow consistent evaluation of the conditions across goals. This integrated evaluation is a key element to the process of determining acceptable prescriptions and evaluating whether different alternative actions across the entire area will meet the desired conditions.

Previously, a number of products were developed and distributed to meet different aspects of the project's original goals. The previous products are as follows:

NED/SIPS - This was the initial NED product, released in 1995 as a disk operating system (DOS) program and subtitled Stand Inventory Processor and Simulator (SIPS). NED/SIPS provided an effective means of creating, managing, and analyzing forest inventory records at the stand level. The user-friendly interface relieved the pain of entering and editing stand inventory data, and once data was entered, a host of analytical tools were available to help understand the data. A variety of reports could be generated describing the vegetation structure, timber value, and economics of the stand. You could apply a set of standard treatments to the stand or design a customized cutting scheme, and utilize one of the four incorporated stand growth simulators to show what the stand may look like in the future.

Forest Stewardship Planning Guide (FSPG) - Published in 1995, this program provides users with exposure to and explanations of a wide range of forest practices that produce a variety of benefi ts from forests. This Windows program guides you through a process of selecting forest stewardship goals. The program offers a great deal of basic information about forests and their management, along with menus of possible stewardship goals. FSPG makes limited recommendations on how to manage a forest for specific goals and describes the conditions that must be created or enhanced to accomplish them.

NEWILD - Published in 1998, NEWILD presents expert knowledge about wildlife habitat requirements in the northeastern United States. NEWILD is based on information presented in the Species/Habitat matrices developed by DeGraaf and Rudis (1986) and DeGraaf et al. (1992).

NED-1 - Completed in 1999, NED-1 partially extended the functionality of NED/SIPS. In NED-1, the forest simulation functionality included in NED/SIPS was dropped, but a migration into the Windows programming environment was accomplished. NED-1 emphasized the analysis of forest inventory data from the perspective of the various forest resources. The resources addressed included aesthetics, ecology, forest health, timber, water, and wildlife. NED-1 evaluated to what degree individual stands, or the management unit as a whole, would provide the conditions required to accomplish specific goals. An extensive hypertext system provided information about the resource goals, the desired conditions that support achieving those goals, and the related data used to analyze the actual condition of the forest.

Stewplan - Published in 2003, Stewplan helps create standard forest management plans (stewardship plans) to facilitate participation in the Forest Stewardship Program. The software, which has been approved by a number of states, is currently used by a number of consulting and service foresters to organize and present information on forest ownership and boundaries, stand inventory characteristics, landowner goals, harvest schedules, and other features necessary for stewardship plans. Stewplan produces a written plan that may be submitted to the Forest Stewardship Program, or a hypertext file that may be modified in a separate word processor.

Getting Help with NED-2

Online help is available for many NED features.

To obtain quick access to help within NED-2, choose from the following actions:

- On the keyboard, press the **F1** key for information on the active NED-2 window or dialog box.
- Double-click a column or row header for help with a particular variable.
- In the Work Pane, double-click a goal or report name for a description.

To open the help system within NED-2, in the **Help menu**, click **Help with NED-2**. To open the help system outside of NED-2, in the **Start menu**, select **Programs** > **NED Programs** > **NED-2 Tools** > **Help**.

In the help system, click the **Index** tab and scroll through the list to find topics of interest. Click the **Search** tab and enter a keyword in the search field to find all topics that reference a word or phrase. When a topic is displayed in the help system, click the **Contents** tab to see where the given topic fits within the help system organization.

Chapter 2 - Guiding Principles and Concepts

Managing at the Landscape Level

Forest stands do not exist in a vacuum. They interact through a variety of processes and events with other stands or landscape elements. Landscape elements can be natural or of human origin, and include forests, rivers, fields, roads, wetlands, hedgerows, lakes, and farmyards. Therefore, natural resource management plans should be developed with an understanding of the interacting environmental and ecological processes that occur in a broader spatial and temporal context, and not be confined to the forest stand level alone. For example, a forest stand may be suitable habitat for an elk population, but the successful migration of the population across a landscape is more dependent on the spatial distribution and composition of an aggregation of forest stands than the composition of a particular stand.

NED follows a general landscape approach to try to ensure that local management decisions are made with an understanding of regional and landscape land uses and ecological conditions, which present unique opportunities and constraints for achieving management goals. Furthermore, because resource management increasingly requires consideration of economic, ecological and social objectives, it is necessary to consider how these objectives might be integrated. The interdisciplinary nature of resource management and the consideration of ecological patterns and processes at broad spatial and temporal scales warrants the use of landscape ecology principles to guide forest management.

The consideration of a broader spatial and temporal context is necessary to achieve long-term resource management objectives, and to avoid undesirable future conditions, such as those associated with cumulative effects and habitat fragmentation.

Cumulative effects are effects initiated by an event that was tied in time or space to other events (e.g., one straw broke the proverbial camel's back, but only because many straws had already been piled on). Cumulative events can be additive (e.g., straws on the camel's back) or compounded (involving more than one process). For example, increased frequencies of high flood events, debris torrents, and dam-break floods can adversely affect aquatic habitats and bury low-gradient stream reaches in debris. The occurrence of such events are not only due to severe storm conditions but to the effects of land management activities such as timber harvesting practices, road density, construction and maintenance standards, and conversion of land cover from forests to other land uses.

Habitat fragmentation usually refers to the conversion of contiguous forests into smaller, isolated fragments, but is sometimes used to describe the creation of openings and associated edge conditions within the forest. Fragmentation usually causes a reduction in forest patch size, an increase in inter-patch distance, and an increase in the amount of forest edge conditions. These edge conditions occur in an outer band of a landscape patch, and can have environmental conditions (air temperature, light, humidity levels, wind condition) that are different from either of the adjacent landscape elements. They can have a positive effect (e.g., for species that require

a combination of patch types or a mix of environmental conditions) or negative effect (e.g., for species that require interior forest conditions) on both plant and animal species. Increased distance between patches can pose a barrier to species dispersal and migration. Populations of species that experience high rates of mortality may have reduced immigration rates because of patch isolation, which can cause higher rates of extinction and a reduction in the number of species found living in isolated patches. The effects of habitat fragmentation and isolation usually involve at least the following classes of phenomena: loss of wide-ranging species that require contiguous habitat, loss of area-sensitive or interior species, erosion of genetic diversity as some populations are lost, and increased abundance of edge species. For example, increase in isolation among forest stands has caused a decrease in neotropical migratory birds that were dominant in forest interiors in Maryland, and increased restriction and isolation of large, wide-ranging species such as the black bear. Fragmentation is a generic problem whereby a forest is divided into fragments that are often lacking sufficient size to provide suitable habitat for interior forest species. Because contiguous forests are composed of many forest stands, the condition and spatial arrangement of multiple forest stands across the landscape are critical in determining the degree of fragmentation of forest habitat. This problem can be approached with concepts and tools that have been developed in the field of landscape ecology.

Landscape Ecology

Landscapes, such as a hardwood forest landscape, a corn and soybean landscape, or a suburban landscape, are land mosaics that extend over kilometers or miles with similar land cover types or landscape elements repeated throughout the landscape. Landscape ecology as a discipline focuses on the spatial relationships among landscape elements, and the distribution of energy, material, and plant and animal species across the land mosaic. Landscape elements can be described in terms of patches, a matrix, and corridors. A patch is a relatively homogeneous area that differs in some way from its surroundings (e.g., woodlot in a corn field, conifer plantation in a mixed-deciduous forest). The matrix is the dominant landscape element on a landscape in which smaller differentiated elements (patches) are embedded. It is often highly connected throughout the landscape. Corridors are usually linear patches or connections between similar patches that differ from the elements on either side. Corridors can function as habitat for some species (especially species that live in edge habitats), serve as conduits or routes of movement between patches, or act as barriers to movement across the matrix. Patches, a matrix, and corridors are usually defined by soil types, topography, dominant vegetation, land use, or even specific vegetation conditions (e.g., closed canopy forest). However, we must recognize that the configuration of these features is scale-dependent (i.e., the apparent configuration may vary with changes in the scale of observation). Furthermore, there are many physical and biotic attributes that can be used to define patches (e.g., particular soil type, vegetation density), and each will produce a somewhat different pattern of patches. Landscape ecology study, and landscape ecosystem management, usually focus on landscape structure, landscape function and landscape change.

Landscape structure describes the characteristics of elements in the landscape mosaic, such as the sizes, shapes, numbers, kinds, and configuration of patches. Measures of landscape structure not only provide information on the type of patches that exist and in what quantities, but also where they are located in relation to each other, to physical and biological features of the landscape (e.g., topography, soil conditions, climate, vegetation types), and to natural and human-caused disturbances.

Landscape function refers to the interactions between landscape structure and the flows of nutrients, water, energy, and the movement of plants and animals across the landscape. For example, the number, kind, and distribution of forest types (landscape structure) help us understand the susceptibility and spread of fire (landscape function) across the landscape. Disturbances that spread (e.g., fire, disease) are more likely to propagate when susceptible patches are contiguous than when they are dispersed. Forest patch size, shape, and type (landscape structure) can also affect a number of ecological processes, such as species dispersal and diversity, hydrological dynamics, and microclimate (landscape function). Bird diversity has been found to increase with increases in forest patch size. This is primarily due to an increase in the number of forest-dwelling, long-distance migrants that require forest habitat away from forest edges. Forest patch shape indirectly describes the edge-to-area ratio for a patch. Shape of forest patches can affect dispersal or home range suitability of animal species by its influence on the amount of edge to interior habitat of the forest patch. Complex shapes tend to have greater edge length than simple shapes. The size of habitat patches and the distance between patches (landscape structure) have implications for the population sizes of animals that live and disperse among the patches.

Landscape structure can also affect landscape change and vice versa. The stability of landscapes elements is related to the amount of biomass present. When little biomass is present, the system has little resistance to change, but may recover rapidly, as in an abandoned field. With considerable biomass present, as in a forest, the system is relatively resistant to disturbance, but recovers more slowly. Because landscapes are not static, landscape change studies usually focus on the alteration in the structure and function over time and space.

Scale

The concept of scale, both spatial and temporal, is important in landscape-level studies. Scale is characterized by both grain and extent. Grain refers to the level of spatial detail or resolution that can be detected on a map or other spatial representation of a landscape. Extent refers to the size of the landscape under consideration, or the longest time span considered. Information is generally lost with increase in grain. The scale at which we describe a landscape depends on the analysis to be performed, the organisms to be studied, the processes to be considered, and the time period of interest.

Ecological processes usually have effects at a particular spatial and temporal scale, and these processes are generally the product of events that occur in comparatively smaller spatial extents and shorter time spans, and are constrained by events that occur in comparatively larger spatial extents and longer time spans. For example, the cycling of nutrients within a forest stand may be the product of chemical reactions in the soil, the activity of decomposers, and primary production by vegetation within the stand. These factors exhibit variability within the stand, and the events that result in nutrient cycling can be measured on time scales of hours to days. But nutrient cycling within the stand is also influenced by factors such as climate and disturbance events in the watershed that might increase the influx of nutrients into the stand. These constraints exist at scales larger than a stand and occur within time periods of months and years.

The description of landscape structure, function, and change in a heterogeneous landscape is also scale-dependent. A forested landscape of 50 square kilometers (km^2) may be described as a heterogeneous landscape because the forest stands that make up the landscape are of varying ages

and types. However, this same forest may appear as a homogenous forest patch when it is viewed within a broader spatial context (i.e., hundreds of km^2) that includes suburban development and agricultural land uses. This is because stands are generally smaller than the grain size used to map this broader spatial extent and thus cannot be represented in a map of this large area.

These examples illustrate the fact that measurements of spatial pattern made at one spatial extent cannot easily be translated to another because landscape structure and processes measured at one scale may not be as important or predictive at another scale.

Land can be viewed in a nested hierarchy of spatial scales. A National Hierarchical Framework of Ecological Units is being developed to stratify the land area into progressively smaller areas of increasingly uniform ecological potentials for use in the management of ecological units. The ecological units are mapped based on factors that directly affect or indirectly express energy, moisture, and nutrient gradients which regulate the structure and function of ecosystems. These factors include climate, topography, water, soils, hydrology, geology, and potential natural vegetation. The hierarchy is developed from both the top-down (e.g., regions to individual forest stands) and bottom-up (e.g., individual stands to regions) approaches; conditions that change at broad scales, such as climate and geology are continually related to conditions that change at finer scales, such as distributions of vegetation and soil characteristics. This approach will allow scientists and managers to evaluate broader scale influences on finer scale conditions and processes, as well as to use finer scale information to determine the significance of broader scale influences. For example, province conditions (e.g., climate, geomorphology) define a broad template (usually millions to tens of thousands of square miles) against which land management prescriptions are made. Physical factors such as climate and geomorphology influence the type of forest resources found in a particular province, which in turn determines the different type of land uses in areas within the province (e.g., section, management area or watershed). Watershed-specific information such as the relationship between soil type and tree species distribution, in turn, can be aggregated as needed to provide information for decision making within a broader spatial context (e.g. section, province).

Forest Types

Forest types characterize the dominant vegetation of a stand, and can be used for classification, mapping, and prescription development, among other uses. In NED, you may choose to enter the forest type directly from a list, or NED will calculate one for you. NED uses an algorithm to classify forest stands into one of about 70 forest types that are commonly recognized in forestry practice of eastern North America. Most stands will fall into one of these types, and the type definitions provide non-ambiguous classification. That is, every stand will qualify for one, and only one, forest type.

Each forest type recognized by NED will map into a “prescription forest type” and a “habitat association matrix” (HAM) forest type for the evaluation of timber goals and wildlife goals, respectively. Most of the NED goals have been developed for northeastern forest types, and forest types from other regions are mapped to approximately 10 northeastern forest types for goal evaluation.

Refer to Chapter 4 (Calculations) in the NED-2 User’s Guide (Twery et al. 2011) for further information on the calculation of forest types.

Silviculture

About Silvicultural Systems

NED-2 does not provide expert prescriptions. However, it does offer recommendations about the silvicultural systems that best achieve the desired future conditions of particular goals. Future NED products may offer expert prescriptions designed to achieve specific goals.

The six silvicultural systems recognized by NED are as follows:

- No Cutting
- Single-tree Selection
- Group and Single-tree Selection
- Patch Cutting
- Two-age Management
- Even-age Management

Forest Type Transitions

Forests grow and change through time. The most likely time for forests to change composition is after a disturbance, and the type of disturbance can have a large effect on the direction of that change. Silviculture, through application of treatments to an existing stand of trees, can be a major influence on the transition of forests from one forest type to another. The timing and intensity of any silvicultural treatment will affect the species composition and the success of regeneration initiated by the treatment. The matrix in Figure 1 represents the combined expert opinion of silviculturists (The NED Timber Committee—see Acknowledgments) familiar with the forest types of the Northeast. It presents the expected transitions from one forest type to another (or to stay the same) under each generally recognized, broad silvicultural system, if that system were to be practiced in a stand in which the starting conditions matched the listed forest type. These are general expectations, and specific stands and customized treatments may produce results that differ.

Forest Type	Silvicultural System: No Cutting	Single Tree Selection	Group & Single Tree Selection	Patch Cutting	Two-Age Mgmt	Crop Tree Mgmt	Even-Age Mgmt
Allegheny Hardwoods (AL)	NH	NH	NH	NH AL	NH AL	AL	AL
Appalachian Hardwoods (AP)	NH	NH	AP NH	AP	AP	AP	AP
Aspen-Birch (AB)	NH	NH	AB	AB	AB	AB	AB
Hemlock Hardwoods (HH)	HH	HH	HH	HH	HH	HH	HH NH ON
Northern Hardwoods (NH)	NH	NH	NH	NH	NH	NH	NH
Oak-Hickory (OH)	OH NH	OH NH	OH NH	OH AL AP	OH AL AP	OH AL AP	OH AL AP
Oak-Northern Hardwoods (ON)	NH	NH	NH	ON	ON	ON	ON
Spruce-Fir (SF)	SF	SF	SF	SF	SF	SF	NH SF
Spruce-Hardwoods (SH)	SF NH	SH	SH	SH	SH	SH	SF NH
White Pine (WP)	NH OH ON	NH OH ON	WP	WP	WP	WP	WP

Figure 1.— Silvicultural forest type transition matrix.

No Cutting

Although rarely listed as a silvicultural technique, no cutting is clearly one of our most important management options. It is the only option that will meet wilderness objectives, and it has important application in many non-wilderness areas where aesthetics and environmental concerns are a major goal of management. Unless supplementary treatments are prescribed, the vegetation is allowed to change and evolve in response to ecological and environmental pressures without direct intervention.

Some goals may require fairly intensive management practices under this system and supplementary treatments might actually include some tree cutting—to build trails, roads, recreational facilities, eliminate hazards, etc. If supplementary treatments are required, there is no systematic, planned series of cuttings designed to manipulate the vegetative cover. For example, a park or wooded property surrounding an estate or office building might receive treatments such as insect/disease control measures, removal of vines, dead trees or limbs and rotten or unsightly trees and brush (perhaps even chipping the wood on site), planting and fertilization of flowering trees and understory shrubs, and similar measures that create a highly attractive, but not necessarily natural environment.

When viewed from the ground, areas managed by the no cutting system usually have a dense, multi-layered canopy with trees of all sizes and ages present. Appearances do not vary appreciably from one stand to another. When viewed from a distance, this system presents a uniform, unbroken canopy appearance.

Single-tree Selection

Under this system, single-tree selection cuttings constitute the sole cutting method. The intent is to create, within a single stand, a self-sustaining forest in which trees of several to many ages and sizes are present, intermingled with each other. Trees to be removed during each cut are selected on an individual basis creating openings up to a tenth of an acre. At every cut, tree regeneration is obtained, immature trees are thinned, and mature trees are harvested.

Cutting is regulated in single-tree selection via structure control. This means that a stand structure goal is established that specifies a residual stand density, maximum tree size, and diameter distribution (usually using the “q-factor” to define a target diameter distribution). All trees in excess of this goal are cut periodically. While regulation of cutting within each stand is achieved via structure, area control also is used to schedule cutting of stands within the management unit.

Single-tree selection favors shade-tolerant species. In northern hardwoods areas, sugar maple often is the single-tree selection objective. American beech and eastern hemlock also are favored in areas where they occur. Under this method, fast-growing, shade-intolerant species such as black cherry, yellow-poplar (also referred to as tulip-poplar or tuliptree), white ash, northern red oak, yellow birch, white birch, and aspen are gradually eliminated or reduced to minor components.

In the oak type, where desirable shade-tolerant species are lacking, single-tree selection produces variable results. On some sites, species such as hickory or red maple or slow-growing white,

chestnut, or post oak may eventually dominate the stand. On other sites, tolerant noncommercial species such as dogwood and sassafras may replace the more desirable oak species. On still other sites, northern hardwoods species may take over, resulting in a type conversion.

As a result of its effect on species composition, single-tree selection usually produces less timber value than other methods (except no cutting). It is used for timber production primarily in northern hardwood forest types where sugar maple is a desirable species.

Single-tree selection has an important advantage in that it maintains a more natural, undisturbed appearance than other cutting methods. A high forest canopy is present at all times. When viewed from a distance, areas managed by single-tree selection often appear undisturbed and they absorb much of the impact of disturbance even when viewed in the foreground or from within the stand. For these reasons, single-tree selection is especially appropriate in heavily used travel zones and areas of high recreation use on public forests. It also is widely accepted on small, privately owned woodlands where timber production is secondary to other goals.

Single-tree selection may have advantages for certain wildlife species that spend their entire life in mature forests; examples include, the barred owl, wood thrush, flying squirrel, and pileated woodpecker. Conversely, it adversely affects species of wildlife that depend on early successional vegetation—deer, rabbit, snowshoe hare, ruffed grouse, bluebirds, and chestnut-sided warblers. Usually, less wildlife species diversity (the number of different species present) exists under single-tree selection than under other silvicultural methods.

Where single-tree selection is used primarily to meet visual or wildlife goals, the cutting specifications need to be adjusted from those used for timber production. For example, some landowners may place a high value on the appearance of “primeval” forests that contain a high percentage of large trees. By raising the maximum tree size and reducing the q factor used to specify residual stand structure, it is possible to increase the number of large trees in a stand and thus dramatically change its visual impact over a period of time. For example, increasing the maximum tree size and reducing the q factor will reduce the number of sapling-size trees and increase the number of large trees, providing a stand with a markedly different appearance.

For certain late successional wildlife species, similar adjustments may be appropriate to increase the proportion of trees old and large enough to contain wildlife cavities or to maintain mast production. This objective also can be achieved simply by reserving particular numbers of cavity and potential cavity trees rather than altering the structure of the entire stand.

When viewed from the ground, areas managed by the single-tree selection system usually have a multi-layered canopy with trees of all sizes and ages present. Appearances do not vary appreciably from one stand to another. Although the canopy is somewhat less dense than under the no cutting system, this difference may be difficult to distinguish except immediately after cutting. When viewed from a distance, this system produces a uniform, unbroken canopy appearance. The slightly less dense canopy (compared to no cutting) is often imperceptible from this viewpoint.

Group and Single-tree Selection

In NED, we have adopted a slightly more restrictive definition for group selection than is often applied elsewhere, because the range of cuttings sometimes labeled as group selection is extremely broad. By using the same term for all cuttings within this range, we tend to obscure important differences that are encompassed by these cuttings. This can lead to improper use of the method and may be misleading to the public, which usually considers openings of more than an acre or so to be clearcuts.

We define the group selection system as a simple variation of single-tree selection. As with single-tree selection, a stand-structure goal is selected, cutting is regulated via structure control, and individual trees are selected for cutting throughout the stand. In addition, groups of trees are removed in locations where stand conditions make this appropriate. Such conditions may include the following: areas where several adjacent trees need to be cut because of their quality, size, or vigor; areas where advance regeneration of desired species is already established; and the openings created by these groups are small—a fifth up to a half acre.

No attempt is made to record individual openings, nor to achieve any particular total area in openings. It is not expected that every part of the stand will eventually be included in an opening. Stands are marked and regulation is achieved in the same manner as with single-tree selection cuts, the only difference being that some small openings are created in the stand. Single-tree selection cutting occurs between the openings.

When openings are larger than a half-acre, the environmental conditions in the openings and the impacts on tree regeneration, wildlife habitat, and aesthetics become much more like those in clearcuts than those we associate with group selection openings. It becomes impossible to regulate cutting via structure when openings are large, therefore, we have chosen to restrict our definition of group selection as described above. Methods that use larger openings and other regulatory procedures are recognized by a more appropriate term.

The addition of small group openings to the matrix of single-tree openings has several important advantages. It often allows the regeneration of species that are less tolerant of shade, thereby improving opportunities for timber production, and wildlife and aesthetic diversity. Small group-selection openings do not maximize percentages of shade intolerants, but they can increase representation of these species. Group selection sometimes maintains acceptable tree species on sites that would be converted to noncommercial or low-value commercial species if single-tree selection were practiced exclusively.

So long as the openings are kept small, negative effects on aesthetics and loss of tree quality on trees bordering openings can be minimized. We generally recommend this combination of group and single-tree selection over single-tree selection alone for all situations except those where an unusual visual or wildlife goal dictates single-tree selection only.

When viewed from the ground, areas managed by the group selection system usually have some variety from place to place within each stand. In some areas, there will be a multi-layered canopy with trees of all sizes and ages present. Other areas will contain younger trees and small openings in the canopy. The openings tend to become difficult to distinguish 5 to 10 years after cutting.

Appearances do not vary appreciably from one stand to another. When viewed from a distance, this system produces a relatively continuous canopy appearance, although the small openings will be visible, and may appear as distinct openings or as an irregularity in canopy density.

Patch Cutting

Patch cutting is one variation of what some might call group selection cutting and others might call clearcutting. The actual application and impact of patch cutting is so different from either of these other methods that it is important to make the distinction.

Patch cutting entails the creation of small openings, usually between 0.25 and 5 acres in size. These openings are larger than group selection openings, and the method of regulation is different.

With openings of this size, it is virtually impossible to regulate cutting by establishing stand-structure goals and selecting trees for cutting based on their size. Instead, cutting is controlled by selecting the desired acreage to be included in openings. All trees in those openings are removed regardless of their individual size relative to some stand-structure goal.

In effect, this method is even-age management within the confines of a single stand. Marking consists of identifying areas to be cut in openings rather than selective marking of individual trees and small groups of trees. The amount of acreage in openings at each cut is calculated as a function of the expected even-age rotation, and the cutting cycle. While the individual openings are not mapped and recorded separately, the total acreage included in openings at each cut is recorded; in fact, it is the method by which cutting is controlled.

With this method, there need be no partial cutting between openings; the harvest/regeneration cut can consist of clearcut patches only. If partial cutting is done between openings, either at the same time or a different time, it is done as an even-age thinning rather than an uneven-age selection cut. This method produces a series of even-age groups of trees within a single uneven-age stand. Each group is managed by even-age procedures even though record keeping is limited to the entire stand. The entire stand will assume uneven-age characteristics even though it is managed as a collection of small, even-age groups. In all respects except size of area defined as a stand, this method uses even-age techniques.

In many cases, the patch cutting system has been adopted and labeled group selection cutting in response to public reaction against clearcutting and even-age management. Unfortunately, this method has characteristics more like even-age silviculture than selection cutting as it is commonly being applied in eastern hardwoods, with openings that tend toward the 5-acre upper limit. Giving patch cutting a label that more accurately describes its application will help to ensure that the public is not misled by our forest plans, clarify its position in the continuum of silvicultural treatments, and aid in the accurate assessment of resource impacts and achievement of desired future forest conditions.

When viewed from the ground, areas managed by the patch cutting system will have considerable variety from place to place within each stand. There will be areas of several acres size with no trees larger than seedlings for at least short periods after cutting. These openings will be

intermingled with other areas of similar size, each containing either seedling-sapling trees, pole-sized trees, or sawtimber-sized trees. Appearances do not vary appreciably from one stand to another. When viewed from a distance, this system produces a patch canopy, with areas of full canopy punctuated frequently by small openings. In some cases, the numerous openings in close proximity to each other can lend a “pock-marked” appearance to the landscape.

Two-age Management

Two-age silviculture, although not a widely recognized system, has many potential uses. With this method, two distinct age classes are maintained on the area at all times; the two-age classes are exactly a half rotation apart.

Harvest-regeneration cuttings are essentially diameter-limit cuttings. Unlike the diameter-limit cuts that have given this method a bad name, these cuts result in the complete removal of one of the two-age classes, rather than high grading of the fastest growing individuals of a single age class.

Imagine a stand containing about half its stocking in trees 100 years old, and the other half in trees 50 years old. The harvest-regeneration cut would remove the older age class and thin among the younger age class, leaving a residual density of only about 30 percent. The open conditions after cutting should allow the establishment of a new age class that is 50 years younger than the residual overstory. After a growth period of 50 years, the process can be repeated, perpetuating two-age classes 50 years apart on the site at all times. Thinnings could occur in the years between harvest cuts if volumes warrant.

Two-age silviculture is a compromise between traditional even-age and uneven-age methods. There is never a complete clearcut. Instead, a forest canopy is maintained on the area at all times, leaving a more acceptable appearance than clearcuts. In addition, environmental conditions after each harvest cut allow the establishment of shade-intolerant species, and cutting can be regulated by efficient area-control methods normally used with even-age management. Higher timber values may be possible in locations where visual goals preclude the use of traditional even-age methods.

Although the only areas currently under planned two-age management are experimental ones, there is ample practical evidence that this cutting method can produce the desired regeneration. Much of the so-called commercial clearcutting in the east at the turn of the century was diameter-limit cutting which left residual densities and structures like those described here. These cuts gave rise to many of our current stands that contain high-value species of several distinct age classes.

The major unknowns about two-age management are the magnitude of the tradeoffs between timber, wildlife, water, and visual resources relative to other silvicultural methods. For aesthetics in particular, the success of this system hinges on the appearance of the harvest cuts. The residual density left after harvest must be sufficient to maintain the appearance of a forest stand, and must not resemble a clearcut. Efforts are underway to evaluate two-age management harvest cuts from this aspect.

Two-age management also offers possibilities for retaining large, old trees that would be more difficult to maintain under other systems. The example given earlier—a 100-year rotation with harvests every 50 years might be useful to provide maximum timber yield under this system. There also is an opportunity to use markedly longer rotations—perhaps twice the normal even-age rotation—for wildlife, aesthetics, biodiversity, and similar purposes. Stands might be managed on a 200-year rotation with harvests every 100 years. This would retain some very large and old trees on the site at all times. Two harvest cuts per rotation would allow the selection of individuals that are healthy enough and suitable species to retain for the extra-long rotation period.

When viewed from the ground, areas managed by the two-age system will be uniform within a single stand, but will vary from one stand to the next. Stands that have just been harvested will have a canopy of near full height, but the stem density will be quite low with only medium-sized trees present. Other stands will contain trees of several or many sizes, and will be at or near full density. When viewed from a distance, this system produces a moderately continuous canopy, although stands just harvested may have an uneven appearance because of the low-canopy density there.

Even-age Management

Within even-age management, a few options for removal exist. The methods include an extended harvest even-age system (shelterwood and deferment cutting) and a more traditional even-age system.

Extended Harvest Even-age System

This is a compromise method between the extremes of the more traditional even-age and uneven-age management. In this variant, all of the traditional even-age techniques are used except for the final harvest-regeneration cut. Instead of clearcuttings, seed-tree cuttings, or traditional shelterwood cuttings to regenerate a new stand, the only harvest-regeneration method permitted is one that incorporates an extended final removal schedule.

One such extended harvest technique includes the shelterwood method. When the stand reaches maturity, a shelterwood sequence is initiated that may require two or three cuts in total. The first, or seed cut, is intended to establish the required amount of advance reproduction. If previous thinnings already have accomplished this, the seed cut is omitted. The removal is always made over two entries. The first reduces overstory density to 30-40 percent, providing enough light for the already established advance regeneration to grow to a height of 10−15 feet (ft). Then the remaining overstory is removed, usually about 10 years later.

The purpose of the two-cut removal is to ameliorate the appearance of more traditional even-age harvest cuts. The large regeneration left after the final removal is sufficiently tall to cover stumps, slash, and soil disturbance, avoiding the period of unsightly appearance usually associated with even-age methods. This three-cut shelterwood sequence also is used for purposes other than aesthetics—for example, to facilitate even-age silviculture on wet or rocky soils, where large regeneration is needed to minimize site limitations.

As with any compromise, the impacts of this method must be weighed carefully for all resources. Often, it can produce timber regeneration equal to that from traditional even-age methods, but at an increase in cost. It may have detrimental effects on early successional wildlife and on wildlife diversity, because the herbaceous early successional vegetation stage usually is reduced or eliminated. The importance of this effect depends on the specific wildlife management goal. Opinions as to the visual improvement over clearcutting are highly variable according to the individual observer, the topography and view distance, and other factors.

Deferment cutting is another extended harvest technique that is appropriate under this system. When the stand reaches maturity, the overstory is harvested except for selected individual trees, whose harvest is delayed. There must be a sufficient number of deferred trees to retain the appearance of a forest stand, and thus ameliorate the visual impact of traditional clearcutting procedures. As with two-age management and the first removal cut of an extended shelterwood, the density required in the reserved trees is still under study.

The reserved trees may be retained for as long as they serve a useful purpose into the next rotation. If harvest occurs as soon as the new stand reaches a height of 10−15 ft the method is identical to the extended shelterwood just described. Often it will be desirable to retain the reserved trees longer, providing time for them to grow larger. Depending on the species and quality of trees reserved, retaining these trees for an extended period could allow them to increase substantially in timber value, or develop cavities or produce mast for wildlife, or add a "large tree" appearance to an otherwise young stand. If they are eventually harvested for timber, the delay also may reduce logging damage, which can be serious if harvesting is done when the new stand is of sapling size. Alternatively, the reserved trees can be killed in place or allowed to die naturally to provide snags and large dead and down material where wildlife and/or diversity goals are more important. If the deferred trees are harvested a half rotation later, this method may be identical to the two-age system.

Neither even-age management with extended harvest nor two-age management are cure-all methods that result in full timber yields while completely resolving the aesthetic and environmental objections to even-age management. Nevertheless, there is considerable opportunity to use both systems effectively in specific situations.

When viewed from the ground, areas managed by the extended harvest even-age system will be uniform with a single stand, but will vary from one stand to the next. Stands that have just had the first harvest cut will have a canopy of near full height, but the stem density will be quite low. Stands that have just had the second harvest cut will be dominated by trees of sapling and small pole size. Other stands will contain trees of several or many sizes, and will be at moderate or high density. When viewed from a distance, this system produces a landscape with large openings intermingled in extensive areas of continuous canopy.

Even-age System

This no-holds-barred, traditional silviculture includes any even-age harvest-regeneration cutting method that may be needed to achieve desired results, including clearcutting, shelterwood cutting in any of its many variations, and seed-tree cutting. Even-age silviculture includes thinnings

and similar intermediate cuttings in immature stands and it can include a host of other cultural practices, such as site preparation and artificial regeneration, when they are needed.

In eastern forests, many of the desired species, including the oaks, black cherry, white ash, red and sugar maple, beech, red spruce, and balsam fir depend on the presence of advance seedlings to regenerate successfully after final overstory removal. Thus, clearcutting is actually a one-cut shelterwood where nature or past thinnings have made the seed cut unnecessary. A two-cut shelterwood sequence is commonly used to improve advance regeneration where it is inadequate either in numbers or size.

Because many hardwood seeds exhibit delayed germination, often there is a considerable seed supply buried in the forest floor. Yellow-poplar, white ash, and black cherry are notable examples. As a result of these factors, and the fact that tree seedlings and herbaceous plants make seedbeds unreceptive to new seeds within a few years of final harvest cutting, seed-tree cutting is rare in eastern hardwoods. Likewise, artificial regeneration is seldom employed; natural regeneration established well before the final removal cut is the rule.

Although clearcutting, shelterwood cutting, and seed-tree cutting have sometimes been defined as separate silvicultural systems, they are only different harvest cutting methods under a single system (even-age silviculture). Which of the harvest cutting methods is used in a particular stand is determined by stand conditions: advance regeneration, interfering plants, and site limitations. In the even-age system, the advantages and disadvantages for particular management objectives are essentially the same no matter which harvest method is used, and all produce even-age stands that are managed similarly thereafter.
Even-age silviculture generally results in forests with a maximum proportion of fast-growing, shade-intolerant, high-value species such as black cherry, white ash, red oak, yellow and white birch, and yellow-poplar. As a result, even-age silviculture generally yields greater returns from timber management than any other system.

Because it is the only system that includes large openings likely to go through an herbaceous plant stage, while also including stands of trees of many age classes (including some mature ones), even-age silviculture generally provides greater plant and wildlife species diversity than any other system. It also can favor an abundance of wildlife species associated with early successional vegetation. In the east, clearcutting is the most effective method for increasing water yields from forested watersheds, though its use for this purpose usually is restricted to municipal watersheds.

Visual effects of even-age silviculture differ widely. Many people find the appearance of fresh clearcuts objectionable, often erroneously associating the method with deforestation and environmental damage. As a result, there has been considerable public pressure to avoid clearcuts and other forms of even-age silviculture for this reason.

On the other hand, even-age silviculture has been used by landscape architects to create variety in the landscape that some find more pleasing than unbroken blocks of identical forest cover. Even-age methods can encourage the establishment of flowering plants and other attractive vegetation. Public objections to clearcutting often can be minimized by careful application of even-age

silviculture—limitations on opening size, blending of shape to fit existing vegetation patterns, measures to reduce slash and soil disturbance, etc.

Nevertheless, clearcutting and associated even-age management practices clearly are unacceptable to the general public in many circumstances despite their biologic and economic advantages. They are the least suitable procedures for use on areas where recreation use is high or where a natural, undisturbed appearance is desired.

The even-age system is easily adapted to meet a variety of objectives. In addition to some of the modifications to ameliorate visual impacts described above, variations in rotation length, harvest cutting cycle, and retention of selected trees during harvest cutting can dramatically alter the effect of even-age silviculture on aesthetic, wildlife, and water resources.

When viewed from the ground, areas managed by the traditional even-age system will be uniform within a single stand, but will vary from one stand to the next. Stands that have just been harvested will have few trees larger than seedling size. Other stands will contain trees of several or many sizes, and will be at moderate or high density. When viewed from a distance, this system produces a landscape very nearly identical to the extended harvest even-age system, with large openings intermingled in extensive areas of continuous canopy.

Crop-tree Management

The crop-tree method is an intermediate treatment that enhances the growth of highly desirable (crop) trees specifically selected to meet your needs. Rapid development of the crop trees is promoted without spending time or money on other trees in the stand. To initiate the system, select crop trees that have healthy crowns capable of maintaining their vigor and providing desirable benefits. In your stands with trees that are at least 25 ft tall (12 to 25 years old), there may be 50 to 75 crop trees per acre. In older previously unmanaged stands, it is common to have 15 to 40 crop trees per acre. Crop trees are enhanced by cutting other trees whose crown touch or extend above or below their crown. This provides the crop trees with more sunlight, moisture, and nutrients. Other trees that do not interfere with the crop trees remain and do not receive intentional tending.

Crop-tree management may be conducted as a series of treatments during the life of the stand. Later treatments may provide income. Each time you do a treatment only release around trees that meet your standards. During the last 20 to 30 years before the crop trees mature, treatments in between the crop trees may admit enough sunlight to permit establishment of a new age class of crop trees. The older age class is removed in one or two cuttings. This leaves a newly regenerated stand of seedlings to replace the old ones. When the crop trees in the new age class are pole-size, the whole process can be repeated (Perkey et al. 1994).

Appendix A - Goal Descriptions

Timber Goals

About Timber Goals

Timber goals in NED are based on the premise that the goals include long-term sustainability. The long-standing forestry principle of "non-declining even flow" of timber products is at the heart of our definition of sustainability, but it is not sufficient. The overall concept of sustainability in NED includes all the resources addressed in NED. Recognizing that conditions inevitably change through time, it is important to identify what measures of those conditions need to be "sustained."

The key factor in evaluating the sustainability of timber goals in NED is the concept of balanced size classes. Presuming that a management unit contains a number of stands in various stages of development, from newly regenerated to very mature, balanced size classes in NED indicate the best estimate of experts regarding the amount of area required in each stage. The proportions in each stage are based on the expected duration of the stage and anticipated progression from one to the next such that the proportions can be maintained through time. Balanced size classes, then, are required to meet any timber goal in NED, because they are a key element in maintaining the availability of material for timber production over the long run.

The primary differences among the individual timber goals are in the timing of treatments, as dictated by the primary desired product. The board-foot production goal indicates longer rotations and an emphasis on larger, more valuable trees, whereas the cubic-foot production goal indicates a desire to capture the most fiber in harvested products and thus emphasizes shorter rotations. The periodic income goal emphasizes regular entries on a relatively short cycle to derive some income, but does not necessarily dictate the type of product to be grown. The net present value goal attempts to balance the value of the product with the time it takes to produce, pushing management toward more returns sooner, but still needs to account for long-term sustainability.

Focus on Board-foot Production

Goal Description

The landowner desires to maximize board-foot volume yield—usually to favor timber products such as sawtimber and veneer, or other high-value products.

Desired Future Conditions

To achieve this goal, the following Desired Future Conditions (DFCs) must be met:

Management unit level:

- Percent of area in regeneration ≥ 5 and ≤ 10;
- Percent of area in sapling + percent of area in pole ≥ 35 and ≤ 45; and
- Percent of area in small sawtimber ≥ 25 and ≤ 35; and
- Percent of area in large sawtimber ≥ 10 and ≤ 15; and
- At least 65% of management unit area satisfies the stand DFCs.

Stand level: Table 1 lists DFCs by prescription forest type. All DFCs for a forest type must be met in order for the stand to meet the DFCs.

Table 1. Desired Future Conditions by prescription forest type for board-foot production.

	Relative density		Basal area		Basal area of AGS	% BA High value spp **	% BA comm. spp
	>=	<	>=	<	>=	>=	>=
Allegheny hardwoods	60	100			30	25	85
Appalachian hardwoods	60	100			30	25	85
aspen - birch			60	140	30	25	85
hemlock - hardwoods	60	100			30	25	85
northern hardwoods	60	100			35	25	85
oak - hickory	60	100			30	25	85
oak - northern hardwoods	60	100			30	25	85
spruce - fir			80	160	35	25	85
spruce - hardwoods			80	140	35	25	85
white pine	60	100			35	25	85

** High value species are dependent on the forest type of the stand:

Forest Type	High Value Species
Allegheny hardwoods	cherry
Appalachian hardwoods	northern red oak, yellow poplar
aspen - birch	paper birch
hemlock - hardwoods	northern red oak, yellow birch, white ash
northern hardwoods	sugar maple, yellow birch, white ash
oak - hickory	northern red oak, white oak
oak - northern hardwoods	northern red oak, yellow birch, sugar maple
spruce - fir	red spruce
spruce - hardwoods	red spruce, yellow birch
white pine	white pine, northern red oak

Treatment Implications

Depending on the stand forest types within the management unit, this choice should lead to the silvicultural system that most easily and economically provides for the regeneration and management of species suitable for high-value products such as sawtimber and veneer. The selected system should be applied using average rotations (based on culmination of mean annual increment in board-foot volume), with thinnings and other intensive treatments to facilitate regeneration and growth as required in the case of even-age management, or with average q factor and maximum tree size parameters in the case of uneven-age management.

See Appendix E for silvicultural guidelines on board-foot production in the following forest types:

Allegheny hardwoods
Appalachian hardwoods
aspen-birch
hemlock-hardwoods
northern hardwoods
oak-hickory
oak-northern hardwoods
spruce-fir
spruce-hardwoods
white pine

Focus on Cubic-foot Production

Goal Description

The landowner desires to maximize cubic volume yield—usually to favor timber products such as pulpwood and other fiber products.

Note: In the Allegheny hardwoods forest type, the values of sawtimber products are so high that landowners may prefer to manage for board-foot production and use the cubic-foot by-products of thinnings to meet cubic-foot objectives.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Percent of area in regeneration ≥ 5 and ≤ 10; and
- Percent of area in sapling + Percent of area in pole ≥ 35 and ≤45; and
- Percent of area in small sawtimber ≥ 25 and ≤ 35; and
- Percent of area in large sawtimber ≥ 10 and ≤ 15; and
- At least 65% of management unit area satisfies the stand DFCs.

Stand level: Table 2 lists DFCs by prescription forest type. All DFCs for a forest type must be met in order for the stand to meet the desired future conditions.

Table 2. DFCs by prescription forest type for cubic-foot production.

	Relative density		Basal area		Basal area of AGS
	>=	<	>=	<	>=
Allegheny hardwoods	60	100			50
Appalachian hardwoods	60	100			30
aspen - birch			60	140	30
hemlock - hardwoods	60	100			30
northern hardwoods	60	100			35
oak - hickory	60	100			30
oak - northern hardwoods	60	100			30
spruce - fir			80	140	35
spruce - hardwoods			80	140	35
white pine	60	100			35

Treatment Implications

Depending on the stand forest types within the management unit, this choice should lead to the silvicultural system that most easily and economically provides for the regeneration and management of species suitable for fiber production. The selected system should be applied using short rotations (culmination of mean annual increment in cubic volume) without thinnings in the case of even-age systems, or using high q ratio and low maximum tree diameter parameters in the case of uneven-age systems.

See Appendix E for silvicultural guidelines on cubic-foot production in the following forest types:

Allegheny hardwoods
Appalachian hardwoods
aspen-birch
hemlock-hardwoods
northern hardwoods
oak-hickory
oak-northern hardwoods
spruce-fir
spruce-hardwoods
white pine

Focus on Net Present Value

Goal Description

The landowner desires to maximize net present value—treating the forest property in the same manner as any other investment.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Percent of area in regeneration ≥ 5 and ≤ 10; and
- Percent of area in sapling + Percent of area in pole ≥ 35 and ≤ 45; and
- Percent of area in small sawtimber ≥ 25 and ≤ 35; and
- Percent of area in large sawtimber ≥ 10 and ≤ 15; and
- At least 65% of management unit area satisfies the stand DFCs.

Stand level: Table 3 lists DFCs by prescription forest type. All DFCs for a forest type must be met in order for the stand to meet the desired future conditions.

Table 3. DFCs by prescription forest type for net present value.

	Relative density		Basal area		Basal area of AGS	% BA High value spp **	% BA comm. spp
	>=	<	>=	<	>=	>=	>=
Allegheny hardwoods	60	100			30	25	85
Appalachian hardwoods	60	100			30	25	85
aspen - birch			60	140	30	25	85
hemlock - hardwoods	60	100			30	25	85
northern hardwoods	60	100			35	25	85
oak - hickory	60	100			30	25	85
oak - northern hardwoods	60	100			30	25	85
spruce - fir			80	160	35	25	85
spruce - hardwoods			80	140	35	25	85
white pine	60	100			35	25	85

** High value species are dependent on the forest type of the stand:

Forest Type	High Value Species
Allegheny hardwoods	cherry
Appalachian hardwoods	northern red oak, yellow poplar
aspen - birch	paper birch
hemlock - hardwoods	northern red oak, yellow birch, white ash
northern hardwoods	sugar maple, yellow birch, white ash
oak - hickory	northern red oak, white oak
oak - northern hardwoods	northern red oak, yellow birch, sugar maple
spruce - fir	red spruce
spruce - hardwoods	red spruce, yellow birch
white pine	white pine, northern red oak

Treatment Implications

Depending on the stand forest types within the management unit, this choice should lead to the silvicultural system that most easily and economically provides for the regeneration and management of species suitable for high-value products. Rotation ages and other silvicultural treatments should be based on the maximization of net present value, over the user-selected time frame. If the management unit fails to maintain a positive net present value, this goal implies that the landowner should consider other resource options within NED or make an alternative investment.

The net present value criterion is generally appropriate for those forest lands owned solely as investments, and for which the owner will actually dispose of the land if it fails to meet the minimum rate of return specified. However, some agencies and companies require the use of this criterion in the evaluation of rotations and use of silvicultural treatments, even though they do not otherwise treat their forest enterprise as an investment.

See Appendix E for silvicultural guidelines on focusing on net present value in the following forest types:

Allegheny hardwoods
Appalachian hardwoods
aspen-birch
hemlock-hardwoods
northern hardwoods
oak-hickory
oak-northern hardwoods
spruce-fir
spruce-hardwoods
white pine

Focus on Periodic Income

Goal Description

The landowner desires to maximize periodic (or annual) income—usually by favoring high-value products.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Percent of area in regeneration ≥ 5 and ≤ 10; and
- Percent of area in sapling + Percent of area in pole ≥ 35 and ≤ 45; and
- Percent of area in small sawtimber ≥ 25 and ≤ 35; and
- Percent of area in large sawtimber ≥ 10 and ≤ 15; and
- At least 65% of management unit area satisfies the stand DFCs.

Stand level: Table 4 lists DFCs by prescription forest type. All DFCs for a forest type must be met in order for the stand to meet the desired future conditions. Click on row headers within the table to go to more information on that subject.

Table 4. DFCs by prescription forest type for periodic income.

	Relative density		Basal area		Basal area of AGS
	>=	<	>=	<	>=
Allegheny hardwoods	60	100			30
Appalachian hardwoods	60	100			30
aspen - birch			60	140	30
hemlock - hardwoods	60	100			30
northern hardwoods	60	100			35
oak - hickory	60	100			30
oak - northern hardwoods	60	100			30
spruce - fir			80	160	35
spruce - hardwoods			80	140	35
white pine	60	100			35

Treatment Implications

Depending on the stand forest types within the management unit, this choice should lead to the silvicultural system that most easily and economically provides for the regeneration and management of species suitable for high-value products such as sawtimber and veneer. Rotation ages should be based on culmination of mean annual increment in periodic income, and other silvicultural treatments should be evaluated on the basis of their effect on income over a long (several rotation) time frame.

This evaluation criterion is generally appropriate for any forest lands not owned solely as investments in timber production. If the land will be retained even though it does not achieve some specified rate of return, annual income is a suitable parameter on which to base silvicultural treatments. This would apply to public forest lands, to most private non-industrial forest land, and even to some forest industry lands. However, not all agencies and industries subscribe to this opinion.

See Appendix E for silvicultural guidelines on focusing on periodic income in the following forest types:

Allegheny hardwoods
Appalachian hardwoods
aspen-birch

hemlock-hardwoods
northern hardwoods
oak-hickory
oak-northern hardwoods
spruce-fir
spruce-hardwoods
white pine

Visual Goals

Create or Enhance Continuous Overhead Canopy

Goal Description

The landowner desires to maintain, insofar as possible, the appearance of an undisturbed mature forest, with tall trees (trees at least 50 percent of their mature height) forming a nearly continuous canopy, and with little or no evidence of tree harvest, regeneration activity, or other visible management. This objective would suit those areas viewed from sensitive locations such as a cottage or public road, or those areas viewed by persons who walk or engage in leisure activities that take them through the area.

If this goal is selected for the management unit, compatible stand level goals include those that strive for large tree and park-like appearances, minimize slash and harvest disturbance, and feature special tree and shrub species.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Openings ≤ 10%; and
- Percent of area satisfying stand DFCs ≥ 75%.

Stand level:

- Canopy closure ≥ 75%;
- Height to bottom of canopy ≥ 10 ft; and
- Percent open plots ≤ 10%.

Note: This goal is about the continuity of the canopy, and not about its height. The only height requirement is that the canopy be overhead.

Treatment Implications

In the absence of other management goals, this choice will lead to a no-cutting silvicultural system. If other goals are also selected, a compromise silvicultural system should be recommended, but cuttings should be limited to those that retain substantial canopy cover in pole timber or larger trees at all times in all stands, and that do not result in openings of more than

¼ acre. If small openings are created, they must represent a small proportion of the total stand area (less than 20 percent of the stand area) at any one time. Uneven-age silviculture with single-tree selection or very small group selection openings are the preferred choice in compromise situations.

Large Scale Variety

Goal Description

Variety within a forested area is obtained by creating a few medium- to large-sized openings that provide the desired variety when viewed from an overlook or landscape position. These openings also provide variety over time, and are perceived as incremental changes that occur as individual stands change in age and vegetation character. This objective would suit those areas where large openings blend with the existing landscape pattern (where the existing landscape includes large-scale variety created by the intermingling of farms, meadows, savannas, etc.) in unbroken forest areas that are relatively flat or isolated and therefore seldom viewed from sensitive locations, and in areas where other resource objectives such as timber production, early-successional wildlife, or water yield are important land uses in addition to aesthetics.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Number of stand size classes ≥ 3; and
- Openings < 67%; and
- Percent of area in each stand size class present ≤ 50%.

Treatment Implications

In the absence of other management goals, this choice should lead to an even-age silvicultural system. Openings will be of stand size; that is, 5 to 40 acres or more, and regulation will be achieved via average rotation lengths, densities, and harvest cutting cycles.

If other resource goals are also selected, the silvicultural system will be a compromise. Even-age silvicultural systems that use three-stage shelterwood cutting or deferment cutting, rather than traditional even-age harvest methods, are useful compromise systems. Treatments may include maintaining stands with canopies at different heights and creating stand-sized openings in the canopy to establish regeneration on a regular basis.

Note: The ideal management scenario to accomplish this goal is to use an even-age system. The management recommendation would typically be to clearcut some portion of the management unit in each treatment cycle. Large scale variety cannot be achieved on a single stand.

Small Scale Variety

Goal Description

Variety within a stand is achieved by creating a number of small canopy openings that are viewed in the foreground from many points within a stand. This objective would suit those landowners and forest users who walk or engage in leisure activities that take them through the forest area, and who like the visual variety and increased plant and animal diversity associated with small open areas that temporarily lack trees larger than seedling size.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Number of stand size classes ≥ 3; and
- Openings ≤ 33%; and
- Percent of area in each stand size class present < 67%; and
- Percent of area satisfying stand DFCs ≥ 75%.

Stand level:

- Number of plot size classes ≥ 2; and
- Percent plots in regeneration size class present ≤ 80%; and
- Percent plots in sapling size class present ≤ 80%; and
- Percent plots in pole size class present ≤ 80%; and
- Percent plots in small sawtimber size class present ≤ 80%; and
- Percent plots in large sawtimber size class present ≤ 80%.

Treatment Implications

In the absence of other management goals, this choice will lead to a silvicultural system using either group and single-tree selection or small patch cuttings. Regulation will include average levels for such parameters as q factor, maximum diameter, cutting cycle, and residual density. If other resource goals are also selected, a compromise may be made in the regulation parameters, but the silvicultural system should be limited to those mentioned above.

Treatments may include creating several areas with canopies of different heights within each stand and creating openings in the canopy to establish regeneration in areas from 1/10 to 2 acres in size.

Large and Small Scale Variety

Goal Description

Variety will be sought both across and within stands.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Number of stand size classes ≥ 3;
- Openings ≤ 67%;
- Percent of area in each stand size class present ≤ 50%; and
- Percent of area satisfying stand DFCs ≥ 30% and < 70%.

Stand level:

- Number of plot size classes ≥ 2; and
- Percent plots in regeneration size class present ≤ 80%; and
- Percent plots in sapling size class present ≤ 80%; and
- Percent plots in pole size class present ≤ 80%; and
- Percent plots in small sawtimber size class present ≤ 80%; and
- Percent plots in large sawtimber size class present ≤ 80%.

Treatment Implications

Techniques described in both large scale and small scale variety goals should be used, including at least two silvicultural systems within the same management unit.

Treatments may include the following:

- Creating several areas with canopies of different heights within each stand;
- Creating openings in the canopy to establish regeneration in areas from 1/10 to 2 acres in size;
- Maintaining stands with canopies at different heights; and
- Creating stand-sized openings in the canopy to establish regeneration on a regular basis.

Note: The ideal management scenario to accomplish this goal is to manage from 30 to 70 percent of the total area with an uneven-age system, and the remainder with an even-age system.

Open Understory Under a Closed Canopy

Goal Description

The landowner desires to create or enhance an open stand appearance that keeps understory vegetation to a minimum, and allows one to see into the stand. The overstory is to be kept dense, to maintain the appearance of an undisturbed forest canopy. This goal will often be associated with the desire to use the stand for various recreational activities.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Shrub layer percent cover < 10%; and
- Stems per unit area < 1000 stems per acre; and
- At least 50% of plots with canopy closure ≥ 70%.

Treatment Implications

A dense-crown canopy should be maintained to discourage understory vegetation. If any partial cuttings are done, they should leave a high residual density. Any understory vegetation that does develop may be controlled by cutting, herbicide, or other periodic treatments, depending upon the landowner's willingness to invest in and use these treatments.

Treatments may include the following:

- Not creating gaps or temporary openings in the canopy that allow sunlight to reach the forest floor;
- Encouraging herbaceous plants, and other low-growing plants; and
- Controlling woody plants in the understory by cutting, spraying herbicides, burning, or other periodic treatments.

Note: An open understory is generally easy to achieve when a closed canopy is present.

Open Understory Under an Open Canopy

Goal Description

The landowner desires to create or enhance an open stand appearance that keeps understory vegetation to a minimum, and allows one to see into the stand. The overstory is also to be sparse or open, creating the appearance of a park or savanna. This goal will often be associated with the desire to use the stand for various recreational activities.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Shrub layer percent cover < 10%; and
- Stems per unit area < 1000 stems per acre; and
- At least 50% of plots with canopy closure > 20% and ≤ 40%.

Treatment Implications

A sparse-crown canopy should be established and maintained via partial cuttings that leave a low residual density. Understory vegetation will tend to proliferate under these open conditions, but

can be kept low by encouraging grass or herbaceous species that interfere with the establishment of woody plants. Periodic treatments to remove woody understory that develops will undoubtedly be required, and may include mechanical removal, fire, or herbicides if the landowner is willing to invest in and use such treatments. A conflict will occur if the landowner indicates that no such treatments are desired.

Treatments may include the following:

- Creating gaps in the canopy;
- Encouraging herbaceous plants, or other low-growing plants; and
- Controlling woody plants in the understory by cutting, spraying herbicides, or burning on a regular basis.

Note: An open understory may be difficult to achieve when an open canopy is present.

Dense Understory Under a Closed Canopy

Goal Description

The landowner desires to create or enhance a stand appearance that maintains a dense understory under a closed canopy to retain the appearance of an undisturbed forest. This goal will often be associated with the desire to use the stand for various recreational activities. In such conditions, one cannot easily see very far or walk through the plants in the understory. Limit treatments to those that have minimal impact on the main canopy.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Shrub layer percent cover > 50%; and
- At least 50% of plots with canopy closure ≥ 70%.

Treatment Implications

Treatments may include creating small temporary openings in the canopy and encouraging or planting shade-tolerant species in the understory.

Note: A dense understory may be difficult to achieve when a closed canopy is present. One suggested approach may be to remove the midstory layer, if present.

Dense Understory under an Open Canopy

Goal Description

The landowner desires to create or enhance stand conditions that permit sunlight to reach through the canopy, resulting in a dense understory where one cannot easily see very far into the stand. The understory plants will flourish requiring little effort beyond opening the canopy. Large trees should be maintained at wide spacing, leaving gaps in the canopy. Periodic treatments are necessary to maintain an open canopy.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Shrub layer percent cover > 50%; and
- At least 50% of plots with canopy closure > 20% and ≤ 40%.

Treatment Implications

Treatments may include creating gaps in the canopy and encouraging or planting woody plants in the understory. Some plants may ascend into the midstory layer which may also require treatment to maintain a dense understory.

Note: A dense understory is usually easy to achieve when an open canopy is present.

Allow Visual Access to Specified Features

Goal Description

The goal is to see a special place such as a meadow, building, playground, pond, shoreline, or some other feature. Maintaining visual access to a feature may require establishing grasses and other low-growing plants. On the other hand, visual access may require clearing plants that are growing at eye level so that you can see under the forest canopy. This goal may require pruning, mowing, burning, cutting, or applying herbicides at periodic intervals to limit tree growth.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Shrub layer percent cover < 10%; and
- Stems per unit area < 1,000 stems per acre.

Note: The user must identify whether a feature to show is present and identify the feature. For analysis purposes only, the above DFCs provide a basis for determining how well existing stand conditions meet the desired effect. These conditions need to be met only in the area between the viewing area and the feature.

Treatment Implications

Treatments may include the following:

- Removing or pruning trees to create a line of sight through the forest;
- Encouraging herbaceous plants, or other low-growing plants; and
- Controlling woody plants in the opening by mowing, cutting, spraying herbicides, or burning on a periodic basis.

Screen Specified Features from Sight

Goal Description

The landowner desires to maintain a dense understory to provide privacy and/or visual or sound screening.

Desired Future Conditions

To achieve this goal, the following DFC must be met:

Stand level: Shrub layer percent cover > 50%.

Note: The user must identify whether a feature to screen is present and identify the feature. For analysis purposes only, the above DFC provides a basis for determining how well existing stand conditions meet the desired effect.

Treatment Implications

A sparse-crown canopy should be maintained to encourage the growth of a dense understory. Partial cuttings will leave a low residual density. Treatments may include encouraging woody plants in the understory and planting evergreen species.

The following conditions should be met between the viewing area and the feature to provide adequate screening:

In northern coniferous forest:

- Depth of coniferous buffer ≥ 45 ft; and
- Relative density ≤ 65% to encourage dense understory and ground layers.

In mid-latitude deciduous forest, for summer screening:

- Depth of deciduous buffer ≥ 75 ft; and
- Relative density ≤ 65% to encourage dense understory and ground layers.

In mid-latitude deciduous forest, for winter screening:

- Depth of deciduous buffer ≥ 90 ft; and
- Relative density ≤ 65% to encourage dense understory and ground layers.

Create or Preserve a Permanent Visual Upland Opening

Goal Description

The landowner desires to create, preserve, or enhance an existing field, pasture, or other permanent opening. A visual opening as defined here has no vegetation taller than 3 ft. A few stems are allowed because frequently a single tree or a few trees, live or dead, may improve the aesthetics of the opening.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Stems per unit area ≤ 3 stems per acre; and
- Shrub layer percent cover ≤ 10%.

Treatment Implications

Specific management efforts need be devoted to preserving or maintaining an existing opening. Care should be taken to maintain adequate cover to minimize erosion.

Treatments may include the following:

- Clearing of existing trees, mechanical site preparation, planting or seeding, and protection against animal damage;
- Encouraging herbaceous plants, or other low growing plants; and
- Controlling woody plants in the opening by mowing, cutting, spraying herbicides, or burning on a regular basis.

Enhance Big Tree Appearance

Goal Description

The landowner desires to create or hasten the development of an old-growth or large-tree appearance.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Stems per unit area in saplings ≤ 1,000 stems per acre; and
- Number of big trees per unit area ≥ 30 trees per acre

Treatment Implications

In even-age silvicultural systems, selection of this goal will result in long rotations. In uneven-age systems, it will result in use of a low q and high maximum diameter. In cases where other goals require silvicultural system compromises, a deferment cutting that retains selected trees for twice their normal rotation length may be advisable to achieve the large tree appearance. Regardless of the system selected, featuring a large tree appearance does not imply that all trees in the stand will be large—the desired appearance can be created with a mixture of tree sizes so long as the large stems dominate the stand visually. The NED default value of a large tree is 18 inches diameter at breast height (dbh). The user may change this threshold. See “Calculation Settings” in the NED-2 User’s Guide (Twery et al. 2011).

Treatments may include increasing tree growth or highlighting large trees that are already present. For example, removing some small- to medium-sized trees might achieve both of these objectives.

Minimize Visual Disturbance and Slash

Goal Description

The landowner desires to minimize adverse visual impacts of slash and disturbance that are common immediately after logging.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Low slash ≤ 20% of plots; and
- High slash = 0% of plots.

Note: We think there will be two types of forest users—those who experience their property via a specific trail system, and those who experience it randomly, using no specific trail system. The above recommendations are designed for the first type of user. If the user is of the second type, the management recommendations should change so that it is a DFC that there be no slash ≥ 18 inches height anywhere in the stand.

Treatment Implications

Tree tops and branches left after logging or timber stand improvement activities are to be lopped, chipped, burned or removed, depending on the visual sensitivity of the stand and the landowner's willingness to invest in such treatments. Other activities should be controlled to minimize visual impacts of logging. For example, skidding equipment and activities should be restricted when soils are too wet, locations of landings and haul roads should be carefully planned, and the height of stumps should be limited.

Specific management recommendations to reduce foreground visual disturbance include the following:

- No slash ≥ 18 inches height within 50 ft of trails;
- No slash ≥ 36 inches height;
- Slash evenly distributed over site;
- All stumps ≤ 36 inches height;
- Most stumps < 18 inches height; and
- Flat top stumps (no barber chairs).

Feature Fall Color of Trees, Shrubs, and Ground Covers

Goal Description

As the days grow shorter in the fall, many deciduous plants display spectacularly colored foliage. The colors range from brilliant yellows, vibrant oranges, and fiery reds, to subtle purples. Trees and shrubs known for their beautiful fall colors can be featured as part of the canopy or understory, or in an opening.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

-
- Fall color trees ≥ 25% of the basal area; and
- Fall color shrubs ≥ 10% cover and fall color shrubs ≥ 25% of shrub layer percent cover; or
- Fall color ground layer ≥ 25% cover.

Treatment Implications

Featuring these plants may or may not influence your other plans. Treatments may include creating an environment suitable for the featured plant's survival based on its requirements and favoring or planting species with interesting fall colors.

Feature Flowers on Trees, Shrubs, and Ground Covers

Goal Description

One of the first signs of spring each year is flowers. Flowers in forested areas and openings add color and attract birds, insects, and people. Flowers often have interesting characteristics such as color, size, arrangement, or fragrance. Trees and shrubs known for their flowers can be featured as part of the canopy or understory, or in an opening.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Trees with showy flowers > 5 stems per acre; or
- Shrubs with showy flowers present on at least 20% of plots; or
- Ground layer with showy flowers present on at least 25% of plots.

Treatment Implications

Featuring these plants may or may not influence your other plans. Treatments may include creating an environment suitable for the featured plant's survival based on its requirements and favoring or planting species with showy or fragrant flowers.

Feature Nuts, Fruits and Berries on Trees, Shrubs, and Ground Covers

Goal Description

Often, the color of fruit is in striking contrast to the greens and browns of forests and meadows. Many people like to gather nuts and berries. Further, many different types of wildlife feed on fruits and nuts year round. Trees and shrubs known for their seeds and fruits can be featured as part of the canopy or understory, or in an opening.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Trees with fruits and nuts ≥ 10% of the basal area; or
- Shrub layer with fruits and nuts + ground layer with fruits and nuts ≥ 5% cover.

Note: This DFC is met if either trees or a combination of shrubs and ground cover provide nuts, fruits, or berries.

Treatment Implications

Featuring these plants may or may not influence your other plans. Treatments may include creating an environment suitable for the featured plant's survival based on its requirements and favoring or planting species with the fruits and nuts of interest.

Feature Contrasting Foliage on Trees

Goal Description

Subtle differences in the color, shape, and size of the leaves of trees and shrubs can be featured. For added variety, you can feature a plant with leaves that looks delicate and fine textured against a backdrop of larger trees. Similarly, you can contrast the textures and colors of coniferous and deciduous plants. Trees and shrubs known for their interesting foliage can be featured as part of the canopy or understory, or in an opening.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level:

- Percent basal area evergreen ≥ 20% and ≤ 40%; or
- Percent basal area evergreen ≥ 60% and ≤ 80%.

Note: This DFC is designed to create the situation where either the deciduous trees or the evergreens dominate in roughly the proportion 70:30. A stand with basal area half in deciduous and half in evergreen species would not satisfy this goal. The term "evergreen" may include species such as rhododendron but not deciduous conifers such as larch.

Treatment Implications

Featuring these plants may or may not influence your other plans. Treatments may include creating an environment suitable for the featured plant's survival based on its requirements and favoring or planting species with contrasting foliage.

Feature Contrasting Forms of Trees

Goal Description

A landowner may have trees and shrubs with interesting forms that can be featured as part of the canopy or understory, or in an opening.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Stand level: Percent plots with interesting trees > 0% plots.

Note: Contrasting forms of trees is seen as a DFC that is not managed for, but is considered achieved if the inventory records the presence of any such tree. At treatment time these trees or shrubs should be retained.

Treatment Implications

Featuring these plants may or may not influence your other plans. Treatments may include creating an environment suitable for the featured plant's survival based on its requirements and favoring or planting species with contrasting form.

Water Goals

Provide Intensive Protection of Water Resource

Goal Description

The landowner desires to go beyond required best management practices used to protect water quality. The conditions only apply in those areas where surface water is present.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level: All buffer strip stands meet stand level DFCs.

Stand level: A stand is a "buffer strip stand" if:

- Riparian = "yes"; or
- Contains a riparian = "yes"; or
- At least 1 plot has riparian plot = "yes".

Buffer strip stands must have the following condition to meet the stand DFCs:

- For all plots with riparian plot = “yes”, relative density ≥ 70%

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no “negative conditions” because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

This goal could be selected by municipal watershed managers, or for sites receiving water-based recreational use. Added precautions in the form of more rigorous applications of best management practices (BMPs) should be recommended. Examples would be applying gravel to all roads left open to the public, locating all roads and skid trails farther from streams than might normally be recommended, and mulching and seeding all exposed soil at stream crossings as soon as crossing structures are installed or removed.

Treatments may include the following:

- Complying with BMPs;
- Maintaining extra wide buffer strips;
- Maintaining plant cover;
- Encouraging rapid establishment of regeneration following treatments;
- Minimizing disturbance, erosion, and sedimentation;
- Restricting use of chemicals;
- Restricting road construction and use; and
- Restricting beavers.

Provide Intensive Protection of Wetlands

Goal Description

Landowners are required by law to follow special precautions on wetlands. The requirements only apply in those areas where surface water is present.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level: All wetland stands meet stand DFCs.

Stand level: A stand will be considered a wetland stand when:

- Wetland = “yes”; or
- Contains a wetland = “yes”.

Wetland stands must meet the following DFCs:

- Relative density ≥ 70%; and
- Percent open plots ≤ 10; and
- Coarse woody debris > 0; and
- Canopy closure ≥ 25.

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no "negative conditions" because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

Management of wetlands is problematical. Definitions of wetlands are not always consistent from place to place, and delineation of wetlands can be subjective. Wetland silviculture is subject to regulations under the Federal Clean Water Act. Selection of this goal implies a need for the landowner to determine if a management unit does have a wetland, and to comply with laws and regulations that protect both the site and water quality.

Treatments may include the following:

- Complying with BMPs;
- Maintaining buffer strips;
- Maintaining at least 70% stocking in the buffer strips;
- Allowing a few mature trees to die in place; and
- Creating small openings less than 1/4 acre in size.

Provide Intensive Protection of Riparian Areas

Goal Description

The landowner wants to pay special attention to protecting water quality and the unique flora and fauna found in riparian areas. The desired conditions only apply in those areas where surface water is present.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level: All riparian stands meet stand DFCs.

Stand level: A stand will be considered a riparian stand when:

- Riparian = "yes"; or
- Contains a riparian = "yes"; or

Riparian stands must meet the following DFCs:

- Relative density ≥ 70%; and
- Percent open plots ≤ 10; and
- Coarse woody debris > 0; and
- Canopy closure ≥ 25.

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no "negative conditions" because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

Riparian areas contain unique species associations and are especially important to protecting water quality and the food chain and physical structure of aquatic habitats. The BMPs normally call for leaving buffer strips of one or more tree heights on both sides of perennial stream channels to protect the stream and riparian area. Selection of this goal may affect the silvicultural system used in stands containing riparian areas.

Treatments may include the following:

- Complying with BMPs;
- Maintaining buffer strips;
- Maintaining at least 70% stocking in the buffer strips;
- Allowing a few mature trees to die in place; and
- Creating small openings less than 1/4 acre in size.

Enhance Habitat for Warm Water Fish

Goal Description

The landowner desires to emphasize managing habitat for warm water fish species in streams flowing through and from the management unit. The conditions only apply in those areas where surface water is present.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level: All riparian stands meet stand DFCs.

Stand level: For this goal, a stand is considered a riparian area when: Riparian = "yes".

Riparian stands must meet the following DFCs:

- Coarse woody debris > 0; and
- Coarse woody debris in water = present; and
- Canopy closure ≤ 70; and
- Percent open plots ≥ 10; and
- Relative density < 70%.

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no "negative conditions" because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

Selecting this goal should lead to special recommendations for treatment of the vegetation along streams and around lakes, ponds, and wetlands. Recommendations should address compatibility with other uses, retention or removal of trees to obtain desired levels of shade, restrictions on harvesting methods in the riparian zone to control erosion and sedimentation, prescriptions to optimize growth and maturation of selected trees, and options for achieving desired levels of organic matter and woody debris in streams. This goal would be best addressed on a watershed rather than a management unit basis. It would primarily affect riparian zones and not the silvicultural systems selected for the remainder of the management unit.

Treatments may include the following:

- Complying with BMPs;
- Maintaining buffer strips;
- Removing some trees to allow sunlight to reach the water surface;
- Allowing a few mature trees to die in place; and
- Prohibiting livestock from entering the buffer strip.

Meet Best Management Practices

Goal Description

Forest managers should comply with appropriate state BMPs. If applicable, click on one of the states below to obtain more specific information on that state's BMPs, or contact your state for further information.

Connecticut, Delaware Illinois, Indiana, Iowa, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Wisconsin, West Virginia

Desired Future Conditions

There are no defined DFCs for this goal.

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no «negative conditions» because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

Selection of this goal implies a need for the landowner to determine if a management unit does have a wetland or riparian area, and to comply with laws and regulations that protect both the site and water quality.

BMPs generally include the following:

- Maintaining buffer strips along streams and around bodies of water;
- Minimizing sedimentation;
- Minimizing changes in water temperature; and
- Minimizing the amount of nutrients that are pulled out of the soil and into the water.

Enhance Habitat for Cold Water Fish

Goal Description

The landowner desires to emphasize managing habitat for cold water fish species in streams flowing through and from the management unit. The conditions only apply in those areas where surface water is present.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level: All riparian stands meet stand DFCs.

Stand level: For this goal, a stand is considered a riparian area when:

Riparian = “yes”.

Riparian stands must meet the following DFCs:

- Coarse woody debris > 0; and
- Canopy closure ≥ 25; and
- Percent open plots ≤ 10; and
- Relative density $\geq 70\%$.

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no “negative conditions” because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

Selecting this goal should lead to special recommendations for treatment of the vegetation along streams and around lakes, ponds and wetlands. Recommendations should address compatibility with other uses, retention or removal of trees to obtain desired levels of shade, restrictions on harvesting methods in the riparian zone to control erosion and sedimentation, prescriptions to optimize growth and maturation of selected trees, and options for achieving desired levels of organic matter and woody debris in streams. This goal would be best addressed on a watershed rather than a management unit basis. It would primarily affect riparian zones and not the silvicultural systems selected for the remainder of the management unit.

Treatments may include the following:

- Complying with BMPs;
- Maintaining buffer strips;
- Maintaining at least 70% stocking in the buffer strips;
- Allowing a few mature trees to die in place; and
- Creating small openings less than 1/4 acre in size.

Limit Peak Flows

Goal Description

The landowner desires to minimize water quantity during peak flow periods.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- All wetland/buffer/adjacent stands meet stand level DFCs; and
- Openings < 25%.

Stand level: A stand is considered a wetland/buffer/adjacent stand when:

- Wetland = “yes”; or
- Contains a wetland = “yes”; or
- Adjacent to water = “yes”.

Wetland/buffer/adjacent stands must meet the following DFCs:

- Relative density ≥ 70%; and
- Percent basal area evergreen > 0; and
- Canopy closure ≤ 25.

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no "negative conditions" because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

Forest harvest affects peak flows in several ways. There is less opportunity for storage of precipitation in the years immediately after harvest, so peak flows may be increased. Also, compaction and careless layout of roads and skid trails can increase surface runoff and add volume to peak flows. On the other hand, where snow packs occur, harvesting can actually reduce peak flows by causing earlier snowmelt and runoff compared to uncut areas. In the absence of other management goals, this choice should lead to a no cutting silvicultural system. If other resource goals are also selected, the silvicultural system should be a compromise, weighted toward less-intensive harvests.

Treatments may include the following:

- Complying with BMPs;
- Maximizing stand stocking and maintain it above 70% relative density;
- Using long cutting cycles;
- Using long rotations;
- Encouraging conifer species; and
- Maintaining less than 25% of the area in openings or trees less than 10 years old.

Maintain or Exceed Existing Flows

Goal Description

The landowner desires to protect against reductions in minimum flow levels. The intention is to sustain water yields during times of drought or other low flow periods. The conditions only apply in those areas where surface water is present.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- All wetland/buffer/adjacent stands meet stand level DFCs; and
- Management unit area ≥ 50 acres.

Stand level: A stand is considered a wetland/buffer/adjacent stand when:

- Wetland = "yes"; or
- Contains a wetland = "yes"; or
- Adjacent to water = "yes".

Wetland/buffer/adjacent stands must meet the following DFCs:

- Relative density < 70;
- Percent basal area evergreen < 30;
- If size class = 1 (regeneration) then, relative density ≤30; and
- If year last treated is less than 10 years ago, then relative density ≥ 30 and percent regeneration sprout < 30.

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no "negative conditions" because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

Changes in species, such as converting hardwoods to softwoods, can reduce water yield, especially during periods of low flow. Silvicultural systems and treatments that would ultimately result in reduced flow, especially at low flow levels, should be eliminated from consideration if this goal is selected.

Treatments may include the following:

- Complying with BMPs;
- Reducing stand stocking to below 70% relative density;
- Using short cutting cycles;
- Using short rotations;
- Encouraging hardwood species;
- Encouraging regeneration from seedlings (over sprouting); and
- Avoiding conversion of hardwood species to softwood species.

Increase Water Yields

Goal Description

The landowner desires to increase water yield to streams and reservoirs during periods of low flow. The conditions only apply in those areas where surface water is present. This goal differs from maintaining existing flows by emphasizing short-rotation clearcut systems to increase water yield.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- All wetland/buffer/adjacent stands meet stand level DFCs; and
- Management unit area ≥ 50 acres.

Stand level: A stand is considered a wetland/buffer/adjacent stand when:

- Wetland = “yes”; or
- Contains a wetland = “yes”; or
- Adjacent to water = “yes”.

Wetland/buffer/adjacent stands must meet the following DFCs:

- Relative density < 70; and
- Percent basal area evergreen < 30; and
- If size class = 1 (regeneration) then, relative density ≤ 30; and
- If year last treated is less than 10 years ago, then relative density ≤ 30 and percent regeneration sprout < 30.

Note: NED-2 assesses goal conditions based on existing surface water features. However, lacking such features, NED-2 assumes that the goal would be satisfied because there are no “negative conditions” because of the absence of surface water features. Therefore, use caution when interpreting the results in situations where such features are absent in one or more stands or absent from the management unit.

Treatment Implications

In the absence of other management goals, silvicultural systems should be chosen to provide optimum reduction in evapotranspiration. Generally this choice will be short-rotation, even-age silviculture with clearcutting as the harvest method. All harvesting operations must comply with BMPs. If other resource goals are selected, silvicultural systems should be a compromise, but must include clearcut openings on short harvest cycles.

Treatments may include the following:

- Complying with BMPs;
- Reducing stand stocking to below 70% relative density;
- Using short rotations;
- Encouraging hardwood species; and
- Encouraging regeneration from seedlings (over sprouting).

Wildlife Goals

About Wildlife Goals

NED-2 can evaluate your management unit to determine if it provides suitable habitat for wildlife species. For the species that you select, NED-2 will provide a stand-by-stand analysis of the DFCs according to the model developed by Cleveland and Finley (1998). Detailed descriptions of the wildlife goals are available for approximately 225 wildlife species. Each goal description includes species information such as range, habitat, movement, and food preferences from DeGraaf and Rudis (1986), followed by the DFCs (Cleveland and Finley 1998) with links to the NED-2 variables used in evaluating habitat suitability.

Enhance Habitat for Wildlife Species Richness

Goal Description

The user wishes to create or enhance habitat for as many wildlife species as possible.

Desired Future Conditions

Management unit level: To achieve this goal, the following DFCs must be met on the management unit:

- Land cover type = forest for ≥ 40% of management unit area; and
- One of the following rules will apply:
  - If stand count > 10, then number of forest types ≥ 3; or
  - If stand count > 3 and ≤ 10, then number of forest types ≥ 2; or
  - If stand count ≤ 3, then number of forest types ≥ 0; and
- Water present; and
- One of the following rules will apply:
  - If stand count < 10, then percent of plots in regeneration > 0; or
  - If stand count ≥ 10, then percent of plots in regeneration ≥ 5; and
- One of the following rules will apply:
  - If stand count < 10, then percent of plots in pole + percent of plots in sapling > 10; or
  - If stand count ≥ 10, then percent of plots in pole + percent of plots in sapling ≥ 20; and
- Percent of area in small sawtimber + percent of area in large sawtimber ≥ 20; and
- Coniferous midstory is present on ≥ 10% of stands; and
- Deciduous midstory is present on ≥ 10% of stands; and
- Coniferous shrub layer is present on ≥ 10% of stands; and
- Deciduous shrub layer is present on ≥ 10% of stands; and
- Ground layer cover is present on ≥ 10% of stands; and
- (% of stands with rock piles = present + % of stands with rock crevices = present + % of stands with caves = present) ≥ 10%; and
- (% of stands with low perch = present + % of stands with high perch = present) ≥ 10%; and
- Dead cavity tree is present on ≥ 10% of stands; and
- Live cavity tree is present on ≥ 10% of stands; and
- Soft mast is present on ≥ 10% of stands; and
- Hard mast is present on ≥ 10% of stands.

Treatment Implications—Treatments may include thefollowing:

- Using even-age and uneven-age systems in different areas of the forest;
- Maintaining cavity trees;
- Maintaining dead and down material;
- Maintaining permanent forest openings; and
- Protecting riparian areas.

Amphibians

Bullfrog (*Rana catesbeiana*)

Goal Description

The user wishes to create or enhance habitat for the bullfrog.

Species Information—Species information includes the following:

Range: Nova Scotia west to Wisconsin, south through the Great Plains to eastern Colorado, Texas and northeast Mexico; throughout the eastern United States, except southern Florida and parts of northern Maine; introduced in California and British Columbia.

Relative abundance in New England: Common, but formerly more abundant.

Habitat: Near shorelines of large bodies of water with emergent vegetation, lakes and river oxbows; highly aquatic; tend to remain in same pools for the summer months if water level is stable; will occupy floating logs far from shore; breeds close to shorelines in areas sheltered by shrubs; hibernates under water in mud and leaves about mid-October, emerges late February to March, and May in New York.

Special habitat requirements: Deep permanent water and emergent vegetation.

Home range/movement: Average distance traveled in summer, 61 to 91 meters (m) in a woodland lake and pond in New York; evening movement of 61 to 213 m to water in Michigan; home range of 131 bullfrogs in an Ontario pond had an average mean activity radius of 2.6 m with minimum and maximum movements of 0.6 and 11.3 m, respectively; males defend territories during breeding season; in a Michigan study, the average distance between males within a chorus was 5.4 m, implying an average minimum territorial radius of approximately 2.7 m.

Food habits/preferences: Any available small animal: fish, other frogs, salamanders, newts, young turtles, snakes, small birds, mice, crayfish, insects, snails, and spiders; also cannibalistic; feeds among the water weeds; an indiscriminate and aggressive predator.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, or northern red oak; and
- Temporary ponds or permanent ponds = present; and
- 20 < Shrub layer percent cover ≤ 50%.

OR

- HAM forest type = white pine/red oak/red maple; and
- Size class = regeneration, sapling, or pole; and
- Temporary ponds or permanent ponds = present; and
- 20 < shrub layer percent cover ≤ 50%.

Treatment Implications

Not available.

Eastern American Toad (*Bufo a. americanus*)

Goal Description

The user wishes to create or enhance habitat for the eastern American toad.

Species Information—Species information includes the following:

Range: Nova Scotia and the Gaspe Peninsula west through central Ontario to Lake Winnipeg, south to eastern Kansas, central Indiana, central Alabama and central North Carolina.

Relative abundance in New England: Common.

Habitat: Found in almost any habitat; gardens, woods, yards with cover, damp soil and a food supply; sea level to mountain elevations; usually in moist upland woods.

Special habitat requirements: Needs shallow water for breeding; hibernates in burrows underground to 30.5 centimeters (cm) deep from October to late March or April.

Home range/movement: Exhibits homing behavior by returning to breeding sites; 264 individuals used the same site annually in Ontario; newly metamorphosed toads showed celestial orientation when leaving ponds; as most movement is nocturnal, course determination is probably during daylight hours.

Food habits/preferences: Terrestrial arthropods, including insects, sowbugs, spiders, centipedes, and millipedes; slugs and earthworms are other invertebrate foods; some vegetable matter is taken accidentally; food species determined by availability; feeds from twilight through the evening hours.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Temporary ponds or permanent ponds = present; and
- Loose soils = present.

Treatment Implications

Not available.

Eastern Spadefoot (*Scaphiopus holbrookii*)

Goal Description

The user wishes to create or enhance habitat for the eastern spadefoot.

Species Information Species information includes the following:

Range: Southeastern Massachusetts extending to New York and southeastern Missouri, south to eastern Louisiana and Florida. Not found in the higher elevations of the Appalachians or the Everglades of Florida.

Relative abundance in New England: Rare.

Habitat: Dry sandy or loose soils in sparse shrub growth or open forest areas. Terrestrial and subterranean, only enters water to breed, usually in temporary rain pools. Prefers forest areas with leaf litter. In farmland areas in Connecticut River Valley, Massachusetts, and pitch pine - scrub oak dunes in New York. Colonies occur along floodplains of major rivers. Emerge in spring from hibernation when soil moisture is sufficient.

Special habitat requirements: Sandy soils, temporary pools for breeding.

Home range/movement: Mean home range about 10 m^2 (108 ft^2) in n. Florida, for 90 percent of captures average home range was about 6.2 m^2 (67 ft^2); occupy one or several underground burrows within home range. Maximum dispersal distances of 9.8 m (32 feet); individuals were recaptured in the same home ranges after 5 years.

Food habits/preferences: Flies, spiders, crickets, caterpillars, true bugs, other ground-dwelling arthropods, earthworms, and snails. (Moths are eaten when they can be caught). Tadpoles are planktonic feeders for the first few days, later becoming carnivorous and sometimes even cannibalistic.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type is white pine/red oak/red maple or white pine; and
- Temporary ponds = present; and
- Loose soils = present; and
- Percent cover of leaf litter > 30.

Treatment Implications

Not available.

Four-toed Salamander (*Hemidactylium scutatum*)

Goal Description

The user wishes to create or enhance habitat for the four-toed salamander.

Species Information—Species information includes the following:

Range: Nova Scotia west to southern Ontario and Wisconsin, south to Alabama and Georgia; absent from most of northern New England; scattered disjunctive populations occur in the eastern United States.

Relative abundance in New England: Uncommon to rare.

Habitat: Wet woodlands, preferably with sphagnum moss; shaded, shallow woodland pools; tamarack bogs; hides in moss, in moist decaying wood, under stones or wet leaves; prefers an acidic environment; found in beech/maple, yellow birch/maple and other hardwood forests, found less often in coniferous woods; in mixed forests in New York; larval stage is aquatic, found in pools and quiet streams with an abundance of moss; typically hibernates in decaying root systems of trees; aggregations may appear during hibernation with rotted wood or leaf litter; maple, alder sapling swamp in Connecticut.

Special habitat requirements: Acidic wet woodlands.

Home range/movement: Unreported.

Food habits/preferences: Small invertebrates, including insects, spiders, and earthworms.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods; and
- Temporary ponds or permanent ponds = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, or white pine/red oak/red maple; and
- Size class = sapling, pole, small sawtimber, or large sawtimber; and
- Temporary ponds or permanent ponds = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Fowler's Toad *(Bufo woodhousii fowleri)*

Goal Description

The user wishes to create or enhance habitat for the Fowler's toad.

Species Information—Species information includes the following:

Range: Southern New England west to central Pennsylvania the north shore of Lake Erie and east shore of Lake Michigan south to Missouri, eastern Oklahoma, Texas, central Georgia and South Carolina.

Relative abundance in New England: Uncommon but locally abundant.

Habitat: Prefers areas with sandy soil-shorelines, river valleys, beaches, and roadside areas; usually found in lowland areas, but frequently in pine and oak forests, gardens, lawns and fields, also found in small marshy ponds; hibernates in burrows in well drained sandy soils to 0.9 m deep from early fall to late spring.

Special habitat requirements: Sandy soils, shallow water for breeding.

Home range/movement: Average distances between captures ranged from 22 to 32 m during a 3-year period on a golf course in Connecticut; night movements of 61 to 213 m or more to reach waters' edge; toads usually found with 30.5 m of previous capture point.

Food habits/preferences: Chiefly ground-dwelling insects, particularly ants and beetles; also consumes earthworms, spiders, snails, and slugs.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, white pine/red oak/red maple, or white pine; and
- Temporary ponds or Permanent ponds = present; and
- Loose soils = present.

Treatment Implications

Not available.

Gray Treefrog (*Hyla versicolor*)

Goal Description

The user wishes to create or enhance habitat for the gray treefrog.

Species Information—Species information includes the following:

Range: Eastern United States and southeastern Canada from southern Maine to Manitoba and south through central Texas and the Gulf states to central Florida.

Relative abundance in New England: Common.

Habitat: Forested regions with small trees, shrubs, and bushes near or in shallow water; often found on moss or lichen on bark of old trees; will breed in temporary pools or permanent water, swamps, bogs, ponds, weedy lakes, and roadside ditches; breeding sites are extremely variable; commonly inhabit moist areas in hollow trees, under loose bark, or in rotted logs during summer months; hibernate under tree roots, under leaves.

Special habitat requirements: Aquatic sites for breeding.

Home range/movement: Unreported.

Food habits/preferences: Small insects, spiders, plant lice, mites, and snails; forages in vegetation and on the ground.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, or northern red oak; and
- Temporary ponds or permanent ponds = present; and
- Shrub layer percent cover > 50%.

OR

- HAM forest type = white pine/red oak/red maple; and
- Size class = regeneration, sapling, or pole; and
- Temporary ponds or permanent ponds = present; and
- Shrub layer percent cover > 50%.

Treatment Implications

Not available.

Green Frog (*Rana clamitans melanota*)

Goal Description

The user wishes to create or enhance habitat for the green frog.

Species Information—Species information includes the following:

Range: Nova Scotia through Quebec and southern Ontario to central Minnesota, south to eastern Oklahoma and east to northern Georgia and South Carolina; absent from central Illinois.

Relative abundance in New England: Common.

Habitat: Riparian, inhabiting margins of shallow permanent or semi-permanent fresh water, shores and banks of lakes and ponds, creeks, woodland streams, limestone quarry pools, springs,

vernal pools, moist woodlands near water; seldom more than a few meters from the water; young often found in semi-permanent water; hibernates underground or underwater from October until March, usually within its home range; may be active on warm winter days.

Special habitat requirements: Riparian areas.

Home range/movement: Range from 20 to 200 square meters (m^2) with an average of 61 m^2 in southern Michigan near a stream and lake; daily movements were less than 10 m for 80% of the 824 individuals recaptured. During breeding season, males maintained a 2- to 3-meter distance between each other. Territory size depends on cover density, 1 to 1.5 m between males in areas of dense cover. Territories with diameters of 4 to 6 m defended in open areas in New York.

Food habits/preferences: Terrestrial feeders among shoreline vegetation; insects and their larvae, worms, small fish, crayfish and other crustaceans, newts, spiders, small frogs, and mollusks are taken; beetles, flies, grasshoppers, and caterpillars constituted over 60% of food items; terrestrial beetles are the most important food item; tadpoles are herbivorous.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods; and
- Temporary ponds or permanent ponds, seeps, or streams = present; and
- 20 < shrub layer percent cover ≤ 50%; and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Green Salamander (*Aneides aeneus*)

Goal Description

The user wishes to create or enhance habitat for the green salamander.

Species Information—Species information includes the following:

Range: Occurs in the Appalachian region: southwestern Allegheny Plateau Province of Pennsylvania, extreme western Maryland and southern Ohio to west central Alabama and extreme

northeastern Mississippi. Also occurs in a disjunctive area in southwestern North Carolina, northwestern South Carolina, and northeastern Georgia.

Relative abundance in New England: Does not occur in New England.

Habitat: Sapling-pole size forests and larger; less abundant in early successional forests.

Special habitat requirements: Surface rocks; rock crevices leading below frost line; moderate ground cover; moderate shrub cover; and dense overstory cover.

Home range/movement: Unreported.

Food habits/preferences: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = Allegheny Plateau; and
- Rock crevices = present; and
- 30 < ground layer percent cover ≤ 75%; and
- 20 < shrub layer percent cover ≤ 50%; and
- Canopy closure > 70%; and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Jefferson Salamander (*Ambystoma jeffersonianum*)

Goal Description

The user wishes to create or enhance habitat for the Jefferson salamander.

Species Information—Species information includes the following:

Range: Western New England to west central Indiana, central Kentucky to western Virginia and north to northern New Jersey.

Relative abundance in New England: Locally common to rare.

Habitat: Terrestrial, found in undisturbed damp, shady deciduous or mixed woods, bottomlands, swamps, ravines, moist pastures, or lakeshores; hides beneath leaf litter, under stones or in decomposing logs and stumps; cleared strips create a barrier for dispersal; upland hardwood forests on glaciated limestone areas northwest of the Great Swamp in New Jersey. In Connecticut, members of the *Ambystoma jeffersonianum* complex are more abundant and widespread in upland areas of the Connecticut River Valley and documented within shale ravines in Connecticut; hibernates on land in winter months, usually near breeding waters; have been found within rotten logs.

Special habitat requirements: Requires temporary ponds for breeding period; egg mortality exceeded 60% in pools more acid than pH 5 in Tompkins County, New York.

Home range/movement: Adults migrated an average of 252 m from breeding ponds to summer range in Indiana; newly metamorphosed individuals moved an average 92 m from the ponds; in hardwood forest of northern Kentucky, adults moved an average of 250 m from ponds in a series of 6 to 8 moves in 45 days.

Food habits/preferences: Small invertebrates, including worms, millipedes, spiders, insects, and aquatic crustaceans; feeds on most animal life that it can capture.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, or birch; and
- Size class = sapling, pole, small sawtimber, or large sawtimber; and
- Temporary ponds or permanent ponds = present; and
- Loose soils = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = northern hardwoods; and
- Size class = sapling, pole, small saw, large saw, or uneven-age; and
- Temporary ponds or permanent ponds = present; and
- Loose soils = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = bottomland hardwoods; and
- Temporary ponds or permanent ponds = present; and
- Loose soils = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Marbled Salamander (*Ambystoma opacum*)

Goal Description

The user wishes to create or enhance habitat for the marbled salamander.

Species Information—Species information includes the following:

Range: New Hampshire and central Massachusetts, central Pennsylvania to southern Illinois, southern Missouri to eastern Texas; throughout the eastern United States except southern Louisiana and Florida.

Relative abundance in New England: Uncommon.

Habitat: Sandy and gravelly areas of mixed deciduous woodlands, especially oak-maple and oak-hickory, trap rock slopes; during breeding seasons, found in low areas around ponds, swamps, and quiet streams; inhabits somewhat drier areas than other species of *Ambystoma*; during the summer usually found under logs and rocks; found at 900 ft above sea level in Connecticut; larvae usually found in temporary water throughout the winter; probably hibernates in deep burrows.

Special habitat requirements: Ponds or swamps in wooded areas for breeding.

Home range/movement: Adults migrate an average of 194 m from breeding sites to summer range in Indiana.

Food habits/preference: Arthropods including adults and larval insects and crustaceans, also takes earthworms and mollusks; marbled salamander larvae eat small aquatic insects, crustaceans, and other small invertebrates and are cannibalistic; larvae rise in the water column to feed.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = bottomland hardwoods, or white pine/red oak/red maple; and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain; and
- Temporary ponds or permanent ponds = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Percent cover rock ≥ 25%; and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Mountain Dusky Salamander (*Desmognathus ochrophaeus*)

Goal Description

The user wishes to create or enhance habitat for the mountain dusky salamander.

Species Information—Species information includes the following:

Range: Appalachian mountains and uplands from New York to northern Georgia at altitudes ranging from a few hundred feet above sea level to timberline in the southern Appalachians; one juvenile specimen from central Vermont, identification debated.

Relative abundance in New England: Rare.

Habitat: Semi-terrestrial, found along stream edges and on the forest floor; in wet woods under forest debris, logs, stones, sometimes beneath the bark of dead trees; near water-small streams, springs, or seeps; seeps and springs used for late autumn and winter hibernation; individuals inhabiting seepage banks are active earlier in spring and later in the fall than streamside individuals.

Special habitat requirements: Seeps, springs, or streams in woodland areas.

Home range/movement: Average movement of 40 to 45 cm between captures of displaced and nondisplaced individuals in a rock-face habitat in North Carolina; homing to the nest shown by breeding females; females are philopatric, ovipositing in the same section of a stream in successive years.

Food habits/preferences: Insects, including adult and larval forms of flies, beetles, wasps, and ants; *Oligochaetes*, also takes other small arthropods; eats shed skin.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods; and
- Province (ignored) = central lowlands, Allegheny Plateau, or Ridge and Valley; and
- Seeps or streams = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Shrub layer percent cover > 50%; and
- Percent cover rock ≥ 25%; and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = bottomland hardwoods; and
- Size class = sapling, pole, small sawtimber, or large sawtimber; and
- Province (ignored) = central lowlands, Allegheny Plateau, or Ridge and Valley; and
- Seeps or streams = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Shrub layer percent cover > 50%; and
- Percent cover rock ≥ 25%; and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = white pine; and
- Size class = regeneration, sapling, pole, or small sawtimber; and
- Province (ignored) = central lowlands, Allegheny Plateau, or Ridge and Valley; and
- Seeps or streams = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Shrub layer percent cover > 50%; and
- Percent cover rock ≥ 25%; and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Northern Dusky Salamander (*Desmognathus f. fuscus*)

Goal Description

The user wishes to create or enhance habitat for the northern dusky salamander.

Species Information—Species information includes the following:

Range: Southern New Brunswick and southern Quebec to southeastern Indiana and central Kentucky to the Carolinas; throughout the northeast excluding southern New Jersey.

Relative abundance in New England: Common to abundant.

Habitat: In woodlands at the margins of cool running water—favors clear rocky streams, in springy banks, seepage areas, beds of semi-dry brooks; under the cover of wet leaves, moss, rock piles, other debris, or in burrows in the soil; ventures from streamside only during wet weather; occurs from sea level to mountain elevations; moves under logs and rocks in deeper water to hibernate in September; may remain active throughout the winter in stream bottoms or deep in unfrozen soil; formerly found in bluffs overlooking the Harlem River in Manhattan.

Special habitat requirements: Permanent streams or seeps in woodlands.

Home range/movement: Less than 3 m along a stream in a wooded ravine in Pennsylvania; average range of 1.4 m^2 in a gravel bottom stream in Ohio; average about 14 m^2 along a stream in Kentucky, maximum movement of 30.5 m as open water dried up; average weekly movement less than 0.5 m; in an intermittent mountain stream, average for 5 individuals was 48 m^2, daily movements less than 2 m.

Food habits/preferences: Small aquatic and terrestrial invertebrates, insects; 96% of prey by weight, grubs, worms, crustaceans, spiders, and occasionally mollusks; sometimes larvae of own species; nocturnal feeder, also active on cloudy or rainy days.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails”.

Stand level:

- HAM forest type = northern hardwoods; and
- Size class = small sawtimber, large sawtimber, or uneven-age; and
- Seeps or streams = present; and
- Rock crevices = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Percent cover rock ≥ 25%; and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine; and
- Seeps or streams = present; and
- Rock crevices = present; and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha); and
- Percent cover rock ≥ 25%; and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Northern Leopard Frog (*Rana pipiens*)

Goal Description

The user wishes to create or enhance habitat for the northern leopard frog.

Species Information—Species information includes the following:

Range: Nova Scotia, South Labrador to southeastern British Columbia, to eastern parts of Oregon, Washington and California, to northern Arizona and New Mexico, and to Ohio, northern New York and New England.

Relative abundance in New England: Common; spotty distribution in southern part of range, very uncommon in parts of formerly occupied range.

Habitat: Commonly found in wet open meadows and fields and wet woods during summer months; river floodplains, Connecticut; breeds in ponds, marshes, slow shallow streams, and weedy lake shores; usually hibernates from October or November to March, hibernates under water or in caves; sometimes emerges in early February and during warm days in winter.

Special habitat requirements: Wet meadows.

Home range/movement: Daily travel within home range reported to be usually less than 5 to 10 m in wet pasture and marsh; average nightly movements during rainy periods was 36 m in Michigan; occasional long-range movement, often exceeding 100 m during rainy nights.

Food habits/preferences: Insects; particularly beetles, lepidopteran larvae, wasps, bugs, crickets, grasshoppers and ants; also takes sowbugs, spiders, small crayfish, snails and myriopods; almost 99% of food items were insects and spiders; occasional records of having taken small birds and snakes; food species taken correlates with peaks in insect prey abundance.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods; and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau; and
- Temporary ponds or permanent ponds or streams = present.

Treatment Implications

Not available.

Northern Spring Peeper (*Hyla c. crucifer*)

Goal Description

The user wishes to create or enhance habitat for the northern spring peeper.

Species Information—Species information includes the following:

Range: Nova Scotia, the Gaspe Peninsula and Quebec to the southern tip of Hudson Bay through Ontario to Lake Winnipeg, south to eastern Texas and throughout the eastern United States, except Florida and southern Georgia.

Relative abundance in New England: Common to abundant.

Habitat: Marshy or wet woods, second growth woodlots, sphagnum bogs, nonwooded lowlands, near ponds and swamps; found on the ground or burrowed into the soil; breeds in permanent or temporary water, usually woodland ponds with aquatic debris; found in cool moist woods after breeding; hibernates on land during late November to January or early spring, under moss and leaves.

Special habitat requirements: Pools for breeding.

Home range/movements: In southeastern Michigan, home range diameters ranged from 1.2 to 5.5m, established around forest debris and vegetation; average daily travel was 6.1 to 39.6 m.

Food habits/preferences: Small nonaquatic insects: preferably ants, flying bugs, beetles, flies, springtails, and spiders; also mites, ticks, and small snails; foods taken probably reflect availability, catchability, and size rather than preference.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods; and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age; and
- Temporary ponds or permanent ponds = present; and
- Shrub layer percent cover > 50%.

OR

- HAM forest type = bottomland hardwoods, eastern hemlock, northern red oak, or white pine/red oak/red maple; and
- Size class = sapling, pole, small sawtimber, or large sawtimber; and
- Temporary ponds or permanent ponds = present; and
- Shrub layer percent cover > 50%.

OR

- HAM forest type = balsam fir, spruce-fir, or red spruce; and
- Temporary ponds or permanent ponds = present; and
- Shrub layer percent cover > 50%.

Treatment Implications

Not available.

Northern Spring Salamander (*Gyrinophilus p. porphyriticus*)

Goal Description

The user wishes to create or enhance habitat for the northern spring salamander.

Species Information—Species information includes the following:

Range: Through the Appalachian range from west central Maine and extreme southeastern Quebec south to eastern Ohio and central Alabama, Pennsylvania and northern New Jersey; absent from the Coastal Plain; recently reported from Rhode Island.

Relative abundance in New England: Uncommon to rare, except in Vermont and northwestern Berkshire County, Massachusetts, where common.

Habitat: Found in but not restricted to forested areas with clear, cold water, springs, mountain streams, creeks, boggy areas; also in depressions under stones or other cover adjacent to water; usually occurs at higher elevations in spruce/fir forests, typically in moist situations, in underground water courses and limestone caves, beech/maple/hemlock forests, in shale ravine streams in Tompkins and Albany Counties, New York; and have been found in hillside meadow streams, swamps, and lake margins.

Special habitat requirements: Streams, seeps, or springs; in winter, wet soil near water where remains somewhat active in burrows.

Home range/movement: Unreported.

Food habits/preferences: Euryphagic predator—consumes aquatic insects and their nymph and larval forms, crustaceans, centipedes, earthworms, snails, spiders, millipedes, small frogs, and salamanders; terrestrial insects were 79% of total prey items in New Hampshire; has been found to eat its own larvae; salamanders account for 50% of the diet in the Appalachians; salamanders a minor part of diet in New York; nocturnal, forages for food among rocks and vegetation in or along stream beds on rainy summer nights; and larvae are generalists feeders until metamorphosis when they take larger food items.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods; and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age; and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau; and
- Seeps or streams = present; and
- Percent cover rock ≥ 25%.

OR

- HAM forest type = bottomland hardwoods; and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau; and
- Seeps or streams = present; and
- Percent cover rock ≥ 25%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, eastern hemlock, or northern red oak, and
- Size class = sapling, pole, small sawtimber, or large sawtimber; and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau; and
- Seeps or streams = present; and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Northern Two-lined Salamander (*Eurycea b. bislineata*)

Goal Description

The user wishes to create or enhance habitat for the northern two-lined salamander.

Species Information—Species information includes the following:

Range: Gaspe Peninsula, Quebec and eastern Ontario southwest through Ohio to eastern Illinois, south to extreme northeastern Mississippi to Virginia.

Relative abundance in New England: Common to abundant.

Habitat: Floodplain bottoms to moist forest floors at high elevations to 1,829 m; along brooks and streams, boggy areas near springs or seeps; found under objects at water's edge in moist soil or in coarse sand and gravel at stream bottoms or edges, leaf litter and crayfish burrows; in wet woodlands or pastures; during wet or humid weather will wander into moist woods more than 100 m from water courses; and hibernates under water, or remains active in feeding aggregations in springs and cold-flowing streams in New York and adjacent unfrozen soil.

Special habitat requirements: Alkaline streams for breeding.

Home range/movement: Average area less than 14 m^2 for 20 monitored individuals along a stream in Ohio; territories were aggressively defended in an artificial environment.

Food habits/preferences: Insects, particularly beetles, beetle larvae, mayflies, stonefly nymphs, and dipterans; also spiders, mites, millipedes, sowbugs, and earthworms; most prey are of terrestrial origin.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, or white pine/red oak/red maple, and
- Streams = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Streams = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Pickerel Frog (*Rana palustris*)

Goal Description

The user wishes to create or enhance habitat for the pickerel frog.

Species Information—Species information includes the following:

Range: Nova Scotia and the Gaspe Peninsula through southeastern Ontario to Wisconsin, southeast to eastern Texas and east to South Carolina; absent from central Illinois, northwestern Ohio and parts of the South.

Relative abundance in New England: Locally common.

Habitat: Colder waters of lakes, ponds, clear streams, springs, sphagnum bogs, limestone quarry pools; in Massachusetts, fairly ubiquitous along streams and shores of permanent ponds and lakes; in summer found in pastures, fields, or woodlands, often at a distance from water; prefers water with thick vegetation at edges for cover; hibernates in mud at bottom of ponds or in ravines under stones from October to March; and some individuals found wintering in caves in Indiana.

Special habitat requirements: Shallow, clear water of bogs and woodland ponds for breeding.

Home range/movement: Unreported.

Food habits/preferences: In adults, 95% of food items were terrestrial arthropods. Snails, small crayfish, aquatic amphipods and isopods are also eaten.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Temporary ponds or permanent ponds or seeps = present, and
- 20 < shrub layer percent cover ≤ 50%.

Treatment Implications

Not available.

Ravine Salamander (*Plethodon richnomdi*)

Goal Description

The user wishes to create or enhance habitat for the ravine salamander.

Species Information—Species information includes the following:

Range: Occurs in the southwestern section of Allegheny Plateau Province of Pennsylvania, mid to southern Ohio, southeastern Indiana, northeastern Kentucky, northwestern North Carolina, southwestern Virginia, and western West Virginia.

Relative abundance in New England: Does not occur in New England.

Habitat: Slopes or ravines with deciduous or mixed forests sapling-pole size or larger (less abundant in early successional habitat types).

Special habitat requirements: Dead and down logs; dense ground cover; dense overstory cover; surface rocks; and forest litter.

Home range/movement: Unreported.

Food habits/preferences: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Province (ignored) = Allegheny Plateau, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Ground layer percent cover > 75%, and
- Canopy closure > 70%, and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Red-spotted Newt (*Notophthalmus v. viridescens*)

Goal Description

The user wishes to create or enhance habitat for the red-spotted newt.

Species Information—Species information includes the following:

Range: Nova Scotia and Gaspe Peninsula, west to the northern shore of Lake Superior and eastern Michigan south to central Alabama, north central Georgia; and absent along coast from southeastern South Carolina, southward.

Relative abundance in New England: Common.

Habitat: Adults found in ponds, particularly water with abundant submerged vegetation, and in weedy areas of lakes, marshes, ditches, backwaters, and pools of shallow slow-moving streams or other unpolluted shallow or semi-permanent water; terrestrial juveniles (efts) live in moist areas on land, typically under damp leaves, under brush piles or logs and stumps, usually in wooded habitats; more common in areas of higher elevation in Connecticut; moist beech-maple-hemlock woods in New York, and oak-pine woods in Massachusetts; may be seen moving about on wet days in spring and summer; efts hibernate on land, burrowing under logs and debris, but most adults remain active all winter underwater in pond bottoms or in streams; and during winter months often found semi-active in groups of 20 to 40.

Special habitat requirements: Water with aquatic vegetation for the adult newt.

Home range/movement: Approximately 270 m^2 for red efts (juveniles) in an oak-pine woodland in western Massachusetts; maximum daily movement was 13 meters; average movement along the edge of a small pond in Pennsylvania was 3.1 m for females and 3.4 m for males; most individuals remain within 1.5 m of shore; movement was random for 323 males in a Virginia pond and the males were considered to be non-territorial.

Food habits/preferences: Both larvae and adults are opportunistic feeders; insects and their larvae, particularly mayfly, caddisfly, midge and mosquito larvae, springtails, tadpoles, frog eggs, worms, leeches, small mollusks and crustaceans, spiders, mites, occasionally small minnows, salamander eggs are also a major food item; also ingests molted skin; snails are an important food source for the red eft; and cannibalism on their own larvae provides an important component of the diet in July and August.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Temporary ponds or permanent ponds = present, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Redback Salamander (*Plethodon cinereus*)

Goal Description

The user wishes to create or enhance habitat for the redback salamander.

Species Information—Species information includes the following:

Range: Nova Scotia west to southern Ontario and eastern Minnesota, south in scattered colonies to Missouri, in the Smoky Mountains, in southern Tennessee and east to Cape Hatteras.

Relative abundance in New England: Abundant.

Habitat: Entirely terrestrial; mixed deciduous or coniferous woods, inhabiting interiors of decaying logs and stumps, also found underneath stones, moist leaf litter and bark; wet areas and extremely moist bottomland avoided; enters xeric, sandy habitats where moist microhabitats exist; hibernates down to 38 cm soil depth or in rock crevices; may be active during mild winter weather; in Indiana, individuals were found active in an ant mound throughout the winter; found hibernating at 76.2 to 91.4 cm depth in decaying root systems of dead white oaks in southeast Massachusetts; and has been found hibernating in aquatic situations in Maryland.

Special habitat requirements: Logs, stumps, and rocks.

Home range/movement: Home range is small because of restricted horizontal movement; movement of less than 30.5 cm for 14 individuals in hardwood forest habitat in New Jersey; individuals usually found under the same object where initially captured; and home ranges of 13 m^2 for females, about 24 m^2 for males were determine in a northern hardwoods forest in Michigan.

Food habits/preferences: Small insects and their larvae, earthworms, snails, slugs, spiders, sowbugs, millipedes, mites; occasionally cannibalistic; mites were the most important food, accounting for 65% of the prey items in a New Hampshire study, insects 73% by weight in a New York study; during rainy summer nights, found on leaf litter presumably foraging for food; and often climbs tree trunks and shrubs in search of food, particularly during wet nights.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Seal Salamander (*Desmognathus monticola*)

Goal Description

The user wishes to create or enhance habitat for the seal salamander.

Species Information—Species information includes the following:

Range: Occurs in the mountainous and hilly regions from southwestern Pennsylvania to northern Georgia and northern Alabama.

Relative abundance in New England: Does not occur in New England.

Habitat: Deciduous, coniferous, or mixed forests; prefers to hide during the day under stones, bark, etc.

Special habitat requirements: Streams; surface rocks (wet); and dense overstory cover.

Home range/movement: Unreported.

Food habits/preferences: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = Allegheny Plateau, and
- Streams = present, and
- Canopy closure > 70%, and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Slimy Salamander (*Plethodon g. glutinosus*)

Goal Description

The user wishes to create or enhance habitat for the slimy salamander.

Species Information—Species information includes the following:

Range: Extreme western Connecticut through central New York to eastern Oklahoma, Arkansas, south in Louisiana to central Florida; scattered colonies in southern New Hampshire and Texas.

Relative abundance in New England: Uncommon to rare.

Habitat: Moist wooded hillsides and ravines; terrestrial, found underneath moist humus, manure piles, in crevices in rock, shale banks, and under logs in woodland areas; in one study the species was found to be most abundant in banks along highways and woodland openings; has been found in second-growth oak-hickory forests and steep hemlock slopes of ravines in the Helderberg Mountains, New York, and to an elevation of 1,768 m in the Great Smoky Mountain National Park; also in mature mixed deciduous forests; hibernates underground from November to March or April.

Special habitat requirements: Rock outcroppings, logs within wooded areas.

Home range/movement: Twenty-two individuals in northern Florida were recaptured at or within 1.2 m of the original capture point; adult home ranges are less than 9 m in diameter; immature range is less than 6 m diameter, in oak-hickory forest with thick leaf litter in North Carolina; mean movement distances were 17.5 m for males, 14.3 m for females, and 4.2 m for juveniles; and probably capable of movements more than 90 m beyond home range area.

Food habits/preferences: Euryphagic; mostly insects, also sowbugs, worms, centipedes, spiders, slugs, and snails; availability probably governs feeding habits; ants and beetles were the most abundant food items in a Virginia study, accounting for 58% of the total weight of food.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and

- Canopy closure > 70%, and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = bottomland hardwoods, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Canopy closure > 70%, and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = eastern hemlock, and
- Size class = small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Canopy closure > 70%, and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Canopy closure > 70%, and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Spotted Salamander (*Ambystoma maculatum*)

Goal Description

The user wishes to create or enhance habitat for the spotted salamander.

Species Information—Species information includes the following:

Range: Nova Scotia and the Gaspe Peninsula to southern Ontario, south through Wisconsin, southern Illinois excluding prairie regions, to eastern Kansas and Texas, and through the eastern United States, except Florida, the Delmarva Peninsula, and southern New Jersey.

Relative abundance in New England: Common though populations declining, probably because of acid precipitation.

Habitat: Fossorial; found in moist woods, stream banks, beneath stones, logs, boards; prefers deciduous or mixed woods on rocky hillsides and shallow woodland ponds or marshy pools that

hold water through the summer for breeding; usually does not inhabit ponds containing fish; terrestrial hibernator; in summer often wanders far from water source; found in low oak-hickory forest with creeks and nearby swamps in Illinois; and have been found in the pitch pine-scrub oak community of the Albany Pine Bush, dense oak forests in Rhode Island.

Special habitat requirements: Mesic woods with semi-permanent water for breeding; eggs tolerate pH range of 6 to 10 with best hatching success at pH 7 to 9; high embryonic mortality occurred in temporary pools with pH below 6 in New York.

Home range/movement: Individuals have been found up to 400 m from the nearest breeding site in North Carolina; will travel 91.2 to 182.4 m from woods to ponds to open meadows in New York; individuals were found to use subterranean rodent burrows as retreats; tagged salamanders that were monitored were found within a 300 cm^2 area of these burrows; displaced adults moved up to 500 m to return to breeding ponds in Massachusetts; average migration of 150 m from breeding ponds in Kentucky 6- to 220-m range in thick oak-hickory forest; and linear migration was unaffected by the presence of absence of vegetation or change in the topography.

Food habits/preferences: Earthworms, snails, slugs, insects, spiders, particularly larval and adult beetles; larval stage may also eat small fish; and cannibalism by larvae occurs under crowded conditions.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Temporary ponds or permanent ponds = present, and
- Loose soils = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%,

Treatment Implications

Treatments may include the following:

- Maintaining a variety of deciduous and mixed deciduous and coniferous conditions across the landscape;
- Maintaining temporary pools of water; and
- Maintaining dead and down material.

Wehrles Salamander (*Pledtodon wehrlei*)

Goal Description

The user wishes to create or enhance habitat for the Wehrles salamander.

Species Information—Species information includes the following:

Range: Occurs in extreme southwestern New York, the Allegheny Plateau Province of Pennsylvania, southeastern Ohio, most of West Virginia, and south central Virginia.

Relative abundance in New England: Does not occur in New England.

Habitat: Sapling-pole size forests or larger.

Special habitat requirements: Dead and down logs; dense ground cover; dense overstory cover; surface rocks; and forest litter; and also found in deep rock crevices and in twilight areas of caves.

Home range/movement: Unreported.

Food habits/preferences: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = Allegheny Plateau, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Ground layer percent cover > 75%, and
- Canopy closure > 70%, and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Wood frog (*Rana sylvatica*)

Goal Description

The user wishes to create or enhance habitat for the wood frog.

Species Information—Species information includes the following:

Range: Atlantic provinces and northern Quebec to Alaska (northern limit is along treeline), south into North Dakota, the Great Lakes States, to the Appalachians in Tennessee and extreme northern Georgia; throughout the northeast.

Relative abundance in New England: Common in suitable habitat.

Habitat: Terrestrial; in mesic woods, often far from water during the summer months as woodland ponds dry up; xeric woods with moist microhabitats; prefers wooded areas with small ponds for breeding; found in boreal conifer forests, swamps and upland hardwood forests to elevations of 1,158 m; found in bogs and trap rock slopes in Connecticut; hibernates under moist forest floor debris or flooded meadows from October to late March; and embryos and larvae showed limited tolerance to water with a high humic content in a Minnesota peat bog.

Special habitat requirements: Prefers temporary woodland pools, back waters of slow-moving streams.

Home range/movement: Average home range size for 453 individuals in a Minnesota peat bog was 65.5 m^2, range 2.9 to 368.3 m^2; distance between captures averaged 11.2 m and ranged from 0 to 71.3 m.

Food habits/preferences: Insects; particularly beetles, flies and hymenopterans, also spiders, snails, slugs, and annelids.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Temporary ponds or permanent ponds = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover of leaf litter > 30%.

Treatment Implications

Treatments may include the following:

- Maintaining forested areas with intermittent streams, temporary pools and puddles; and
- Maintaining dead and down material.

Reptiles

Black Rat Snake (*Elaphe o. obsoleta*)

Goal Description

The user wishes to create or enhance habitat for the black rat snake.

Species Information—Species information includes the following:

Range: Southwestern New England, west through southern New York to south central Illinois, and the Mississippi River area in Wisconsin, south to Oklahoma, central Louisiana and Georgia; range may be extending north in the Connecticut River Valley.

Relative abundance in New England: Common.

Habitat: Variety of habitats including woodlands, thickets, field edges, farmlands, rocky hillsides and mountaintops, river bottoms, old barns. Readily climbs trees; found in dry oak and oak-hickory woods, and mesic bottomland forests, may occur in very dense woods; in Connecticut found in gorges and some coastal areas; hibernates late November to April, may use talus slopes, cisterns or unused wells; and often found in groups with copperheads and rattlesnakes where these snakes occur.

Home range/movement: Average at least 600 m in diameter for males, and at least 500 m for females in woods and fields in Maryland.

Food habits/preferences: Small mammals account for 60% of prey items, particularly rodents, small birds and their eggs (30%), also amphibians, insects, spiders; young opossums, weasels, owls, and sparrow hawks have been captured as food; and prey is killed by constriction.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%.

Treatment Implications
Not available.

Bog Turtle (*Clemmys muhlenbergii*)

Goal Description

The user wishes to create or enhance habitat for the bog turtle.

Species Information—Species information includes the following:

Range: Scattered colonies through New York, south to northeastern Maryland, southern Virginia, western North Carolina and Georgia.

Relative abundance in New England: Endangered.

Habitat: Unpolluted open sphagnum bogs or wet meadows; sluggish clear meadow streams with muddy or mucky bottoms; frequents shallow meandering waterways in swamps and wet meadows; in Connecticut, associated with open canopy and calcareous wetlands; hibernates mid-autumn to late March or April; hibernaculum is in a subterranean rivulet or seepage area with continually flowing water in New Jersey; commonly basks in spring and early summer; and in New Jersey bogs, individuals found basking on sedge grass tussocks or in open shallow pools.

Special habitat requirements: Abundance of grassy or mossy cover, high humidity, and full sunlight.

Home range/movement: Average range was 1.28 hectare (ha) for 19 individuals in Lancaster County, Pennsylvania; ranging from 0.008 to 0.943 ha traveling through wet runs; average movement was 12 m between recaptures for a male; when displaced, the same individual moved 0.4 km in 1 day returning to initial point of capture.

Food habits/preferences: Omnivorous; eats berries (20%), insects (80%), also slugs, earthworms, crayfish, frogs, snakes, nestling birds, seeds of pond weeds and sedges, snails, carrion; availability determines food consumption; and forages on land and under water.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, or bottomland hardwoods, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain, and
- Temporary ponds or permanent ponds, seeps, or streams = present, and
- Loose soils = present, and
- 30 < ground layer percent cover ≤ 75%.

Treatment Implications

Not available.

Broad-headed Skink (*Eumeces laticeps*)

Goal Description

The user wishes to create or enhance habitat for the broad-headed skink.

Species Information—Species information includes the following:

Range: Occurs in the Piedmont Plateau and Coastal Plain Provinces of Pennsylvania to central Florida, west to eastern Kansas and east central Texas.

Relative abundance in New England: Does not occur in New England.

Habitat: Northern hardwoods, red oak, or bottomland hardwoods (wet site) forest types.

Special habitat requirements: Dead and down logs; sparse ground cover, moderate overstory cover; and dead trees with cavities.

Home range/movement: Unreported.

Food habits/preferences: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

-
- HAM forest type = northern hardwoods, bottomland hardwoods, or northern red oak, and
- Province (ignored) = Piedmont Plateau, or Coastal Plain, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Ground layer percent cover ≤ 30%, and
- Dead cavity tree = present, and
- 30 < canopy closure ≤ 70%.

Treatment Implications

Not available.

Eastern Box Turtle (*Terrapene c. carolina*)

Goal Description

The user wishes to create or enhance habitat for the eastern box turtle.

Species Information—Species information includes the following:

Range: Southeastern Maine and the Thousand Island region of New York west to the Mississippi River, central Illinois and south to northern Florida.

Relative abundance in New England: Locally common, more abundant farther south; declining in many areas.

Habitat: Woodlands, field edges, thickets, marshes, bogs, stream banks; typically found in well drained forest bottomland; young semiaquatic; has been observed swimming in slow-moving streams and ponds; found chiefly in open deciduous forests; also found on mountain slopes in Massachusetts; during hot dry weather may rest in mud or water or burrow under logs or decaying vegetation for extended periods; when not active, rests in brush piles and thickets; and hibernates from depths of several inches to 0.6 m below surface in loose soil, decaying vegetation, mud, or in stream banks from late fall to April.

Special habitat requirements: Old fields, powerline clearings, ecotones with sandy soils favored.

Home range/movement: From 45.7 to 228.4 m; 12 individuals averaged movement of 118.8 m on Long Island; for 62 individuals in mixed woodlands and open habitat on Long Island, averaged range was less than 228.4 m; average diameter of 106.6 m in Maryland; one individual was found within 0.4 km from point of release 60 years previously; maintains same home range for many years, occasionally leaves normal home range for random wandering or egg laying; and homing instinct displayed by 45 out of 60 turtles.

Food habits/preferences: Younger individuals chiefly carnivorous, older individuals more herbivorous; food items include animals such as earthworms, slugs, snails, insects and their larvae, particularly grasshoppers, moths and beetles; crayfish, frogs, toads, snakes, and carrion; vegetable matter such as leaves, grass, bugs, berries, fruits, and fungi.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Ground layer percent cover > 30%, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or coniferous shrub layer cover > 0%.

Treatment Implications

Not available.

Eastern Garter Snake (*Thamnophis s. sirtalis*)

Goal Description

The user wishes to create or enhance habitat for the eastern garter snake.

Species Information—Species information includes the following:

Range: Nova Scotia to eastern Manitoba south to eastern Texas, and throughout the Eastern United States. Intergradation with *T. s. pallidula* occurs in northern New England.

Relative abundance in New England: Very abundant; most common and widespread.

Habitat: Ubiquitous, terrestrial; found in moist areas, forest edges, stream edges, fence rows, vacant lots, bogs, swamps, overgrown yards; one specimen found under a rock in a stream through a dark hemlock grove; found in almost all damp environments, from river bottoms to mountain elevations; hibernates, often gregariously, in holes, rock crevices, mud, anthills, rotted wood, uprooted trees, house foundations, and sometimes partially or completely submerged under streamed rocks, from October to March or April; one of the earliest snakes to emerge from hibernation; and can survive the winter above frost line.

Home range/movement: Approximately 2.0 ha, most ranges were smaller in cutover agricultural fields in Indiana; activity range of about 0.8 ha in Michigan woodlands and open fields; home ranges of 14 ha for males and 9.1 ha for females were found in mixed habitat in Kansas; and many individuals migrate from hibernacula to summer ranges.

Food habits/preferences: Earthworms account for 80% of food items, also amphibians, carrion, fish, leeches, caterpillars, other insects, small birds, rodents; also slugs, other snakes, mollusks, crayfish, sowbugs.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Ground layer percent cover > 75%

Treatment Implications

Not available.

Eastern Milk Snake (*Lampropeltis t. triangulum*)

Goal Description

The user wishes to create or enhance habitat for the eastern milk snake.

Species Information—Species information includes the following:

Range: Southeastern Maine and southern Ontario to central Minnesota, south to Tennessee and western North Carolina and throughout the northeast; intergrades with the scarlet king snake (*L. t. elapsoides*), in the southwestern and southeastern portion of its range.

Relative abundance in New England: Common.

Habitat: Various habitats, usually with brushy or woody cover, and found from sea level to mountain elevations; usually found under cover; farmlands, woods, outbuildings, meadows, river bottoms, bogs, rocky hillsides, rodent runways; found under logs, stones, boards, well covers, stones in creek bottoms or other cover during the day; in pine forests, second-growth pine, bog woods, hardwoods, aspen stands; and hibernates from October or November to April.

Special habitat requirements: Suitable cover or loose soil for egg laying.

Home range/movement: About 20.25 ha for *L.t. syspila*, movements of 76.2 to 396.2 m in open woodland in northeastern Kansas; seasonal movement probable from drier hibernation sites to moist bottomlands for the summer.

Food habits/preferences: Mice, other small mammals, other snakes, lizards, birds and their eggs, slugs; mice accounted for 74% of the volume of stomach contents of 42 milk snakes in Pennsylvania; and forages for food at night.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

  - HAM forest type = aspen, northern hardwoods, bottomland hardwoods, or northern red oak, and
  - Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
  - Percent cover rock ≥ 25%.

OR

- HAM forest type = white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Eastern Ribbon Snake (*Thamnophis s. sauritus*)

Goal Description

The user wishes to create or enhance habitat for the eastern ribbon snake.

Species Information—Species information includes the following:

Range: Southern Maine to South Carolina and the Florida panhandle; southern Indiana south to eastern Louisiana; northern limits through southern Indiana to central New England.

Relative abundance in New England: Generally common, but uncommon in Connecticut.

Habitat: Semiaquatic, inhabiting stream edges, swamp areas, wet meadows, ponds, bogs, and ditches; prefers areas with brushy vegetation at waters' edge for concealment; also in damp or wet deciduous or northern pine forests; seldom far from cover; may escape high ground temperature in summer by seeking shelter in shrubs or underground; and hibernates from October to March.

Special habitat requirements: Mesic woodlands with aquatic habitat.

Home range/movement: Average activity range of about 0.8 ha, average distance traveled was approximately 85.3 m in open Michigan grassland and marsh.

Food habits/preferences: Frogs, toads, and salamanders account for 90% of prey items; usually smaller or metamorphosed individuals were taken; also mice, spiders, minnows, and some insects.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Permanent ponds or streams = present, and
- Ground layer percent cover > 75%, and
- Percent cover rock ≥ 25%.

OR

- HAM forest type = bottomland hardwoods, and
- Permanent ponds or streams = present, and
- Ground layer percent cover > 75%, and
- Percent cover rock ≥ 25%.

OR

- HAM forest type = white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Permanent ponds or streams = present, and
- Ground layer percent cover > 75%, and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Eastern Smooth Green Snake (*Opheodrys v. vernalis*)

Goal Description

The user wishes to create or enhance habitat for the eastern smooth green snake.

Species Information—Species information includes the following:

Range: Nova Scotia, southern Ontario, into central Minnesota to southern Wisconsin, Michigan, northeastern Ohio to the Appalachians of Virginia and West Virginia and north from central New Jersey throughout New England with the possible exception of northern Maine.

Relative abundance in New England: Common, but currently declining in southern New England.

Habitat: Upland areas, grassy fields, mountain meadows; high altitude areas with grassy, open spots; also found in open aspen stands, sphagnum bogs, marshes, in vines and brambles, and hardwood stands.

Special habitat requirements: Upland grassy openings.

Home range/movement: Less than 27.4 m for 10 of 12 individuals studied in an uncultivated field in Illinois.

Food habits/preferences: Insects account for 73% of prey items, also spiders, snails, salamanders, millipedes, centipedes, particularly caterpillars, orthopterans, ants, and flies.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, and
- Province (ignored) = Allegheny Plateau, Piedmont Plateau, or Coastal Plain, and
- Ground layer percent cover > 75%.

OR

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, or northern red oak, and
- Size class = regeneration or large sawtimber, and
- Province (ignored) = Allegheny Plateau, Piedmont Plateau, or Coastal Plain, and
- Ground layer percent cover > 75%.

Treatment Implications

Not available.

Five-lined Skink (*Eumeces fasciatus*)

Goal Description

The user wishes to create or enhance habitat for the five-lined skink.

Species Information—Species information includes the following:

Range: Southern end of Lake George, New York and southeastern New York south to northern Florida, west to central Texas; northern limit from Pennsylvania, Ontario to central Wisconsin and northern Missouri.

Relative abundance in New England: Rare in the Northeast through southeastern Connecticut; records for Massachusetts are from Barre and New Bedford.

Habitat: Mesic wooded areas, open or moderately dense with ground cover; most abundant around old buildings and open woods; frequently in damp spots, under logs, rock piles, leaf litter, sawdust piles; suns for brief periods on warm days; found on open talus slopes in mixed deciduous woodlands, New York; primarily terrestrial, but will climb snags to find insects; hibernates from October until mid-March in decaying logs or below the frost line, underground or under large rocks.

Special habitat requirements: Open woods with logs and slash piles.

Home range/movement: Males home range diameter about 27.4 m, females about 9.1 m, in eastern Kansas; and individuals may remain in same home range or move after emerging from hibernation.

Food habits/preferences: Primarily insects and spiders, also snails, grubs, small vertebrates, including young mice; lizards occasionally eaten; and will eat its own shed skin.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, or bottomland hardwoods, and

- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- 30 < ground layer percent cover ≤ 75%, and
- Percent cover rock ≥ 25%.

Treatment Implications
Not available.

Northern Black Racer (*Coluber c. constrictor*)

Goal Description
The user wishes to create or enhance habitat for the northern black racer.

Species Information—Species information includes the following:

Range: Southern Maine to southwestern Ohio, south to central Alabama to South Carolina and throughout the eastern United States.

Relative abundance in New England: Locally abundant.

Habitat: Moist or dry areas, forests and wooded areas, fields, roadsides, swamps, marshes, clearings, near old buildings, trap rock ridges, stone walls, and farms; has been found in deciduous and pine forests; partially arboreal; will use ledges for sunning; hibernates in large congregations, sometimes with copperheads and rattlesnakes, often using deep rock crevices or abandoned woodchuck holes; among the earliest snakes to emerge from hibernation.

Home range/movement: Very territorial; seems to have definite home range; average distance of 275.2 m in mixed Maryland habitat for three individuals after 2 years; requires large tracts of mixed old fields and woodlands.

Food habits/preferences: Varied diet includes small mammals, insects, frogs, toads, small birds, birds' eggs, snakes and lizards; small mammals and insects are 50% of diet.

Desired Future Conditions
To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Northern Brown Snake (*Storeria d. dekayi*)

Goal Description

The user wishes to create or enhance habitat for the northern brown snake.

Species Information—Species information includes the following:

Range: Eastern United States from southern Maine and southern Canada west to Michigan, south to South Carolina; range overlaps that of the Midland brown snake; reported from Somerset Co., Maine, October 1984.

Relative abundance in New England: Common.

Habitat: Ubiquitous, found in urban and rural areas, dry or moist situations, vacant lots, parks, and trash piles; may be abundant along railroad tracks; in the wild, found in damp woods, swamps, clearings, bogs, roadsides, open fields; hides under stones, banks, logs, brush piles, leaves; rare in old-growth forests; hibernates in large groups from October to November until March or April; may use ant hills or abandoned mammal burrows.

Home range/movement: Average daily movement of 3.0 to 4.6 m on Long Island; 13 of 32 individuals displayed homing behavior.

Food habits/preferences: Slugs, snails, earthworms, insects, minnows, and tiny toads are occasionally eaten.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Coarse woody debris > 50 ft3/ac (3.5 m3/ha), and
- Percent cover rock ≥ 25%

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Northern Coal Skink (*Eumeces a. anthracinus*)

Goal Description

The user wishes to create or enhance habitat for the northern coal skink.

Species Information—Species information includes the following:

Range: Occurs in the Allegheny Plateau and Valley and Ridge Provinces of Pennsylvania and in Appalachian Mountains of Maryland, West Virginia, Virginia, and Kentucky; also, in west central New York.

Relative abundance in New England: Does not occur in New England.

Habitat: Forests.

Special habitat requirements: Sparse ground cover; surface rocks; and forest litter.

Home range/movement: Unreported.

Food habits/preferences: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Province (ignored) = Allegheny Plateau, or valley and ridge, and
- Streams = present, and
- Ground layer percent cover ≤ 30%, and
- Percent cover rock ≥ 25%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Northern Copperhead (*Agkistrodon contortrix mokeson*)

Goal Description

The user wishes to create or enhance habitat for the northern copperhead.

Species Information—Species information includes the following:

Range: Southwestern New England to southwestern Illinois, south to central Georgia and through central North Carolina.

Relative abundance in New England: Uncommon to rare.

Habitat: Usually associated with deciduous forests; occupies varied habitats from swamps to mountain tops; prefers areas with damp leaf litter; exposed mountainous, rock hillsides, talus slopes, basalt ridges, ledges, open woods; found in habitats with large rocks, rotting wood, and sawdust piles; during summer months may be found near swamps, ponds, or streams; largely outside of white pine-northern hardwoods and beech-maple associations; and species has been found to use relatively open areas with high rock density and low density surface vegetation.

Special habitat requirements: Rocky hillsides, talus slopes.

Home range/movement: In mixed habitat of woodlands, ledges and grassland in Kansas, 9.7 ha for males and 3.4 ha for females; and seasonal movements occur between hibernaculum and lowland areas.

Food habits/preferences: Mice, other small rodents, insects, small birds, salamanders, lizards, small snakes, frogs, toads; and food obtained by ambush.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, eastern hemlock, northern red oak, or white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Northern Redbelly Snake (*Storeria o. occipitomaculata*)

Goal Description

The user wishes to create or enhance habitat for the northern redbelly snake.

Species Information—Species information includes the following:

Range: Nova Scotia to southern Manitoba, south to eastern Texas, Georgia, and throughout the eastern United States.

Relative abundance in New England: Locally abundant.

Habitat: Moist woods, hillsides, sphagnum bogs, upland meadows and valleys; found under surface debris, also around abandoned buildings; occurs at elevations from sea level to mountains; prefers woodlands: pine, oak-hickory, aspen, hemlock groves; more frequently found in upland woody ridges; occasionally found in damp meadows, marshy areas, swamp and bog edges; hibernates from fall to March or April; active through mid-October in Connecticut.

Special habitat requirements: Woodlands.

Home range/movement: One adult found 30.4 m from release point in Michigan after 7 days.

Food habits/preferences: Consumes slugs, earthworms, soft insects and larvae, and sowbugs; occasionally small salamanders.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Percent cover rock ≥ 25%.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Northern Ringneck Snake (*Diadophis punctatus edwardsi*)

Goal Description

The user wishes to create or enhance habitat for the northern ringneck snake.

Species Information—Species information includes the following:

Range: Nova Scotia, southern Ontario to Wisconsin; eastern and southern Ohio to southeastern Illinois, northern Alabama and northeast through central Virginia to New England.

Relative abundance in New England: Common.

Habitat: Secretive, found under cover especially in moist shady woodlands with abundant hiding cover: stony woodland pastures, rocks, stone walls, old woodland junk piles, logs, debris, loose bark of logs and stumps; shale banks in Maine, and boards are all used as cover; hibernates from September to April or May; and one individual found in a woodchuck den.

Special habitat requirements: Mesic areas with abundant cover.

Home range/movement: Undocumented.

Food habits/preferences: Toads, frogs, salamanders, earthworms, lizards, small snakes, insects, and grubs.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, balsam fir, spruce-fir, red spruce, or eastern hemlock, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Percent cover rock ≥ 25%.

OR

- HAM forest type = northern hardwoods, bottomland hardwoods, or northern red oak, and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Northern Water Snake (*Nerodia s. sipedon*)

Goal Description

The user wishes to create or enhance habitat for the northern water snake.

Species Information—Species information includes the following:

Range: Southern Maine, southern Ontario to northern Wisconsin, south through Kansas to eastern Colorado, northern Oklahoma to central Indiana, Kentucky, and Tennessee, east to North Carolina and New England.

Relative abundance in New England: Abundant in suitable habitat.

Habitat: Aquatic and semiaquatic habitats; common around spillways and bridges where rocks provide cover, uncommon in deeply shaded woodland swamps and ponds, probably because of the lack of basking sites; found in the vicinity of rivers, brooks, wet meadows, ponds, swamps, bogs, old quarries; inhabits salt or fresh water, absent from heavily polluted waters; prefers still or slow-moving water; and hibernates in crevices of rocky ledges, or in banks adjacent to water habitat.

Special habitat requirements: Branches or logs overhanging the water, or boulders of dams and causeways in reservoirs.

Home range/movement: One individual moved 115.8 m along a river after 2 years; in large ponds at an Indiana fish hatchery 80% were recaptured in the same pond, 89% were in the same pond or an adjacent pond; snakes along streams had larger home ranges.

Food habits/preferences: Cold-blooded vertebrates; fish account for 61% of food items, frogs and toads 21%, salamanders 12%; also insects, crayfish, recently dead fish; in another study, fish accounted for more than 95% of diet; may occasionally take shrews and mice.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, and
- Permanent ponds or streams = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock $\geq 25\%$.

Treatment Implications

Not available.

Queen Snake (*Natrix septemvittata*)

Goal Description

The user wishes to create or enhance habitat for the queen snake.

Species Information—Species information includes the following:

Range: Occurs throughout Pennsylvania except in the Valley and Ridge Province; also occurs from southern Great Lakes region to Gulf Coast; a disjunct area is found in Arkansas and southwestern Missouri.

Relative abundance in New England: Does not occur in New England.

Habitat: Forests.

Special habitat requirements: Temporary or permanent ponds; surface rocks.

Home range/movement: Unreported.

Food habits/preferences: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = central lowlands, Allegheny Plateau, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain, and
- Permanent ponds or streams = present, and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Timber Rattlesnake (*Crotalus horridus*)

Goal Description

The user wishes to create or enhance habitat for the timber rattlesnake.

Species Information—Species information includes the following:

Range: Southern New Hampshire, the Champlain Valley to southwestern New York, west along the Ohio River Valley and north to the Mississippi River in Wisconsin; extending to northern Texas and southern Illinois, northern Georgia and through the Appalachians to New Jersey.

Relative abundance in New England: Uncommon to rare.

Habitat: Timbered areas with rocky outcroppings, dry ridges, and second growth deciduous or coniferous forests with high rodent populations; usually southern exposures; sometimes in swamps, quarries, old stone walls, abandoned buildings; often found near streams in late summer; most common in areas not frequented by man, few such sites remain; reaches elevations of 1,800 m in the southeast, but probably not found at highest elevations in the northeast because of the harsh climatic conditions; in Pennsylvania the species frequented forested habitats rather than dry, rocky outcroppings; hibernates from September to April in large numbers in rocky crevices usually overgrown with brush; found with copperheads and other snakes, because of paucity of hibernacula.

Special habitat requirements: Rock outcroppings on forested hillsides.

Home range/movement: Females return to hibernation dens to give birth to young; hibernation dens may be used year after year; home ranges and favored refuges probably exist, but few investigations have been conducted.

Food habits/preferences: Prefers warm-blooded prey; small mammals account for 87% of prey taken, particularly mice, but includes rabbits, shrews, chipmunks, squirrels, bats, songbirds, and other snakes; and forages at night.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, or Blue Ridge, and
- Percent cover rock ≥ 25%.

Treatment Implications

Not available.

Wood Turtle (*Clemmys insculpta*)

Goal Description

The user wishes to create or enhance habitat for the wood turtle.

Species Information—Species information includes the following:

Range: Nova Scotia west through the Great Lakes region to eastern Minnesota; in the east extending south to northern Virginia.

Relative abundance in New England: Once common, population declining.

Habitat: Frequents slow-moving meandering streams with sandy bottoms and overhanging alders; basks during morning hours along banks of streams; disperses from water sources during summer months to fields, woods, and roadsides; restricted to hardwood forest areas in New Jersey; pine barrens area, Rhode Island.

Special habitat requirements: Wooded river banks; open sandy nesting areas.

Home range/movement: One male moved an average of 90 m for three recaptures, one female was found 15 m from initial capture point; exhibited fidelity to a particular stream or brook in New Jersey, and Pennsylvania; mean home range was 447 m for 10 individuals in lowland forest.

Food habits/preferences: Omnivorous; eats young vegetation, grass, moss, mushrooms, berries, insects and their larvae, worms, slugs, snails; also carrion, tadpoles, frogs, and fish; feeds in water or on land.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

  - Streams = present, and
  - Loose soils = present, and
  - Coarse woody debris > 50 ft3/ac (3.5 m3/ha), and
  - 30 < ground layer percent cover ≤ 75%, and
  - Shrub layer percent cover > 50%, and
  - Deciduous shrub layer or coniferous shrub layer cover > 0%.

Treatment Implications

Not available.

Birds

Acadian Flycatcher (*Empidonax virescens*)

Goal Description

The user wishes to create or enhance habitat for the Acadian flycatcher.

Species Information—Species information includes the following:

Range: Breeding—most of eastern North America, including northeastern Pennsylvania, southwestern and southeastern New York and casually to southern New England. Winter—Costa Rica to northern South America.

Relative abundance in New England: Common.

Special habitat requirements: Breeding—deciduous woodlands, shaded ravines, heavily wooded bottomlands, river swamps, hammocks of cypress ponds.

Nest site: Usually suspended in hammock-like structure from the fork of a branch frequently near water; nests are often far out from the trunk and shaded.

Foraging: Major foods—moths, caterpillars, beetles, wasps, bees, and some wild berries.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, or white pine/red oak/red maple, and
- Size class = large sawtimber, and
- Deciduous shrub layer cover > 0%, and
- 30 < canopy closure ≤ 70%, and
- Low perch = present.

Treatment Implications

Not available.

Alder Flycatcher (*Empidonax alnorum*)

Goal Description

The user wishes to create or enhance habitat for the alder flycatcher.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to Alaska, southern to eastern and northern Pennsylvania, central Minnesota and central British Columbia. Winter—Central and South America.

Relative abundance in New England: Common (Maine) to uncommon (southern New England).

Habitat: Breeding—low, damp thickets bordering bogs, swamps and marshes; often in alders, willows, elders, sumacs, and viburnums; prefers open areas.

Special habitat requirements: Areas with dense, low shrubs and clearings (edges).

Nest site: In low tree or shrub saddled on a branch or in an upright fork.

Foraging: Major foods—flying insects. Substrate—air. Techniques—kawking and flight gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer cover or ericaceous shrub layer cover > 0%, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = white pine, and
- Size class = sapling or pole, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer cover or ericaceous shrub layer cover > 0%, and
- 15 < Canopy closure ≤ 30%.

Treatment Implications

Not available.

American Crow (*Corvus brachyrhynchos*)

Goal Description

The user wishes to create or enhance habitat for the American crow.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to British Columbia, south to Florida, the Gulf Coast and southern California. Winter—Southern Canadian Provinces and south.

Relative abundance in New England: Common.

Habitat: Interior and edges of open deciduous, coniferous, and mixed forests and woodlots; prefers woodland with adjacent farmland. Winter—large flocks often congregate in coastal areas where food is more accessible.

Nest site: Usually in crotch of tree near trunk or on a horizontal limb; prefers to nest in conifers when available.

Territory size: Crows non-territorial in Kansas and highly social in many activities.

Sample densities: In Maryland, 0.6 pair per 40 ha in mixed woodland and farmland habitat; four pairs nested within a distance of 91.4 m in Kansas; three pairs per km^2 in favorable habitat in North Dakota.

Foraging: Major foods—crows are omnivorous, taking mammals (mainly carrion), insects, small birds (nestlings), fruit, garbage, and grain. Substrates—a variety of substrates; techniques: aerial searching, followed by quick descent to ground. Preferred feeding habitat—cultivated grain fields.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, small sawtimber, or large sawtimber, and
- Soft mast or Hard mast = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

American Goldfinch (*Carduelis tristis*)

Goal Description

The user wishes to create or enhance habitat for the American goldfinch.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to British Columbia, south to Georgia, Colorado, and southern California. Winter—central Maine, south to Florida, the Gulf States, and Mexico.

Relative abundance in New England: Common.

Habitat: Breeding—open weedy fields, pastures with scattered trees near villages and farms, forest edges, open swamps. Winter—woodlands.

Special habitat requirements: Open weedy fields, scattered woody growth for nesting.

Nest site: Usually in a fork formed by three or four upright branches or on a horizontal limb of a tree.

Territory size: Goldfinches do not always show strong territorial behavior; average territory size of 38 pairs was an area 20 m in diameter in a dry marsh in Wisconsin.

Sample densities: In Wisconsin, 38 pairs per 2.6 ha of dry marsh; in North Dakota, 15 pairs per km^2 in favorable habitat; in Maryland, 21 territorial males per 40 ha in shrubby field with stream-bordered trees.

Foraging: Major foods—insects, buds, succulent vegetation (in summer); seeds of weeds, birches, alders, conifers (in winter). Substrates—tips of weed stalks, fruit-bearing branches of trees and shrubs. Techniques—Ground, shrub and leaf gleaning, and breaking open seed hands. Preferred feeding habitat—feeding areas may be a mile or more from nest site.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, and
- Size class = sapling or pole, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer cover or ericaceous shrub layer cover > 0%.

OR

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, or

- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer cover or ericaceous shrub layer cover > 0%.

Treatment Implications

Not available.

American Kestrel (*Falco sparverius*)

Goal Description

The user wishes to create or enhance habitat for the American kestrel.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland and Quebec, west to Alaska, south to South America. Winter—central New England, west and south to northern limit of wintering population depends on snow depth.

Habitat: Breeding—open areas with a few trees containing cavities, wet meadows, forest edges near open ground, orchards, farm buildings, cities. Winter—same as breeding habitat.

Special habitat requirements: Nest trees with dbh greater than 30.5 cm for nesting; open country with low vegetation; elevated perches from which to sight prey; snags. Nest site—in cavities of trees, under eaves of buildings, cliffs, rarely in old nests of other birds; accepts manmade nest boxes; kestrels frequently nested in abandoned flicker holes or natural cavities located 2 to 10 m above the ground. Territory size—142 ha.

Home range: Breeding and wintering home ranges were of similar sizes in Wyoming; both covered about 5.2 km^2; average diameter of 7 km; home range was 0.5 km; average diameter of 2.2 km for four nests in farming area.

Sample densities: In Holland, 33 pairs per 18 km^2 in nest boxes; in Pennsylvania, 6 pairs per 1.3 km^2 in nest boxes; maximum pairs 0.28 per 40 ha; in central Utah, 45 pairs per 2.6 km^2; in Michigan, 0.16 pairs per km^2.

Foraging: Major foods—insects (staple) especially grasshoppers, crickets and beetles; mammals such as small mice, shrews; small birds; reptiles, and amphibians. Substrates—meadow grasses, air. Techniques—hawking, hovering, and diving to ground.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, and
- Live cavity tree or dead cavity tree = present, and
- Canopy closure ≤ 15%, and
- High perch = present.

Treatment Implications

Not available.

American Redstart (*Setophaga ruticilla*)

Goal Description

The user wishes to create or enhance habitat for the American redstart.

Species Information—Species information includes the following:

Range: Breeding—From limit of tree growth, south to Oregon, Arkansas, North Carolina, and the mountains of Georgia. Winter—Mexico and the West Indies to Ecuador and British Guiana.

Relative abundance in New England: Common.

Habitat: Breeding—in orchards, saplings bordering on pastures, second-growth deciduous woodlands (occasionally coniferous or mixed); in shade trees and shrubbery about dwellings, second-growth maples; also in willow and alder thickets bordering ponds and streams; most abundant in extensive, sapling/pole stage deciduous woodlands.

Nest site: In upright crotch of a tree or on a horizontal limb, sapling, or shrub.

Territory size: Slightly less than 0.4 ha per pair; 0.4 ha or less per pair; 0.8 ha per male; six territories on 0.6 ha (average 0.1 ha); 9 territories on 0.6 ha (average 0.1 ha) in orchard, second-growth woodland comprised of sugar maple, basswood, hackberry, black cherry, and elm with younger trees and sumac as understory along western Lake Erie.

Sample densities: In a thick stand of young sugar maples (saplings) with a scattering of large deciduous trees, 7 males were sighted 10 to 20 m apart in area 100 m^2; 36 pairs per 40 ha Harbor Island, Maine, in white spruce; 51 territorial males per 40 ha in well drained floodplain forest in Maryland, and 91 territorial males per 40 ha in second-growth river swamp.

Foraging: Major foods—insects such as caterpillars, bugs, flies, moths, small grasshoppers, beetles, and wasps; also takes spiders and small amounts of fruit. Substrates—dead tree limbs,

foliage, and air. Generally feeds at heights between 1.5 to 15.2 m. Techniques—branch and twig gleaning hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, spruce-fir, and
- Size class = sapling, pole, or small sawtimber, and
- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%.

OR

- HAM forest type = birch, bottomland hardwoods, balsam fir, red spruce, eastern hemlock, northern red oak, or white pine/red oak/red maple, and
- Size class = large sawtimber, and
- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%.

Treatment Implications

Not available.

American Robin (*Turdus migratorius*)

Goal Description

The user wishes to create or enhance habitat for the American robin.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland west to Alaska, south to South Carolina, Texas, Mexico and southern California. Winter—Southern Maine west to British Columbia, south to Mexico and Gulf Coast.

Relative abundance in New England: Abundant.

Habitat: Breeding—Open woodlands and woodland edges and clearings, fields, orchards, shade trees in residential areas; densities are frequently greater in residential areas than in the wild, though urban populations may not be self-supporting. Winter—frequents sheltered wooded

areas more than open exposed pasturelands; roosts among evergreens in swamps and feeds on persistent wild and cultivated fruits.

Nest site: Robins use a variety of sites for nesting; they prefer to build on a horizontal branch or in a fork of a tree but commonly use shrubs and ledges of buildings; first nest of season is often in a conifer and successive nests in hardwoods; white pine, maple, and apple trees are preferred nest trees.

Territory size: In Wisconsin, 0.1 to 0.3 ha; 0.4 to 0.24 ha (average 0.1 ha).

Sample densities—In Illinois, 132 birds per 40 ha in urban residential areas; in central Illinois, 56 birds per 40 ha in edge shrubbery; in Illinois, 14 birds per 40 ha in second growth or cut-over woods.

Foraging: Major foods—wild and cultivated fruits, earthworms, insects. Substrates—rich loamy soil, fruit bearing trees, shrubs, and vines. Techniques—running, pausing and seizing prey, and gleaning. Preferred feeding habitat—grassy fields, orchards, lawns, and gardens.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Deciduous midstory cover > 25%, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Not available.

American Tree Sparrow (*Spizella arborea*)

Goal Description

The user wishes to create or enhance habitat for the American tree sparrow.

Species Information—Species information includes the following:

Range: Breeding—Quebec, west to Alaska, south to Newfoundland, north Manitoba and northern British Columbia. Winter—Maritime Provinces, west to southern British Columbia, south to South Carolina, New Mexico and northern California.

Relative abundance in New England: Common.

Habitat: Winter—open country, brushy edges of fields, weedy pastures, marshes, hedgerows, and farmland.

Foraging: Major foods—in winter, grass and weed seeds. Substrates—leaf litter, grasses, and weeds. Techniques—ground gleaning. Preferred feeding habitat—see wintering habitat.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, and
- Deciduous shrub layer cover or ericaceous shrub layer cover > 0%.

Treatment Implications

Not available.

American Woodcock (*Scolopax minor*)

Goal Description

The user wishes to create or enhance habitat for the American woodcock.

Species Information—Species information includes the following:

Range: Breeding—southern Newfoundland, southern Quebec, west to southeastern Manitoba, south to Florida and Texas. Winter—southern New Jersey and the Ohio Valley, south to central Florida and southeastern Texas.

Relative abundance in New England: Common (Maine) to uncommon; rare in winter along coast.

Habitat: Breeding—moist woodlands in early stages of succession, swamps, stream banks, bogs, rich bottomlands, often in thickets of alder, willow or maple, brushy edges of woods, dry open woods and fields. Winter—concentrate along rivers and streams.

Special habitat requirements: Fertile, moist soil that contains earthworms; fields or small forest openings for courtship activities and nocturnal roosting; dense brushy swales for diurnal cover.

Nest site: On forest floor or abandoned field in slight depression lined with a few dead leaves; usually located within 45.7 m of an edge; hidden in a variety of cover from grasses to young or middle-aged hardwoods of light to medium density.

Territory size: Females do not defend nests; the singing ground of the male may range in size from about 0.1 ha to more than 40 ha.

Sample densities: In New Hampshire and Maine, 4 to 7 males per 1.6 km singing ground surveys in 1971 and 1972; in brushy abandoned farmland in Maryland, 5.6 territorial males per 40 ha; in Maryland, 1.5 territorial males per 40 ha in cut and burned woodland.

Foraging: Major foods—earthworms accounted for 50 to 90 percent of diet; larvae of beetles, flies and other insects for the balance; leaves, seeds, and fruit are occasionally taken. Substrates—soft earth, mud, leaf litter, and dry grasses. Techniques—probing, gleaning. Preferred feeding habitat—open pastures, cultivated fields, and stream banks.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, or bottomland hardwoods, and
- Size class = regeneration, sapling, pole, or small sawtimber, and
- Temporary ponds or permanent ponds, seeps, or streams = present, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, or white pine, and
- Size class = regeneration, and
- Temporary ponds or permanent ponds, seeps, or streams = present, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = aspen, and
- Size class = regeneration, and
- Permanent ponds = present, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Treatments may include the following:

- Maintaining variety in conditions within a small area;
- Creating some areas with dense, newly regenerated hardwoods (can be mixed with conifers);
- Creating some areas with sapling and pole-sized hardwoods (can be mixed with conifers); and
- Maintaining some permanent forest openings at least 1 ac in size.

Barn Swallow (*Hirundo rustica*)

Goal Description

The user wishes to create or enhance habitat for the barn swallow.

Species Information—Species information includes the following:

Range: Breeding—Labrador, west to Alaska, south to Georgia, Alabama, and Mexico. Winter—South America.

Relative abundance in New England: Common.

Habitat: Breeding—farmlands, rural, and abandoned areas.

Special habitat requirements: Manmade structures, especially buildings, for nesting; open barns with suitable areas for nest construction on beams.

Nest site: Nests inside sheds and barns (often in colonies), under bridges, culverts; formerly nested on cliffs, in caves and in niches in rocks.

Territory size: Probably restricted to the nest site.

Sample densities: Usually 6 to 8 nests per site is maximum, but as many as 55 nests have been reported in a single barn and 63 at a Lunenburg, Massachusetts barn; in North Dakota, 8 pairs per km^2; 11 pairs per 40 ha in mixed agricultural and residential habitats including buildings.

Foraging: Major foods—Flying insects, occasionally takes fruits. Substrate—air. Techniques—hawking, skimming water surface. Preferred feeding habitat—over ponds, lakes, rivers, and fields; seldom feeds more than 0.8 km from nest site.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, and
- Ground layer percent cover > 75%.

Treatment Implications

Not available.

Barred Owl (*Strix varia*)

Goal Description

The user wishes to create or enhance habitat for the barred owl.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to Alberta, south to Florida and the Gulf Coast. Winter—same as breeding range.

Relative abundance in New England: Uncommon and scattered.

Habitat: Breeding—low, wet deep woods, heavily wooded swamps often near open country where it may hunt for food; frequently uses mixed or coniferous woods for nesting and roosting; prefers mature oak woods for nesting and feeding. Winter—in times of food shortage, birds often migrate south in search of food.

Special habitat requirements: Cool, damp lowlands, and large trees with cavities for nesting; minimum dbh of suitable trees is 50.8 cm.

Nest site: Typically in a large natural cavity in a dead tree; where cavities are scarce, it may use old bird or squirrel nests; in New York, owls often roost in dense stands of hemlock or pines.

Home range: Average size for 9 owls was 228.7 ha (range 86.2 to 369.2 ha) in deciduous woodland, open field, and marsh habitat in Minnesota.

Sample densities: In Michigan, 3 pairs per 93.2 km^2 in extensive deciduous woodlots; in Maryland, 0.5 pair per 40 ha in lowland forest.

Foraging: Major foods—mice (staple) and other small mammals, frogs, birds, insects, and crayfish. Substrates—forest floor and meadow grasses. Technique—swooping and pouncing.

Preferred feeding habitat: Open fields surrounded by woodland.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Live cavity tree or dead cavity tree = present, and
- Canopy closure > 70%.

Treatment Implications

Treatments may include the following:

- Maintaining a variety of forest conditions intermixed with areas not dominated by trees across the landscape;
- Maintaining an average tree size of about 15 inches dbh;
- Maintaining at least 2 trees 20 inches dbh on every acre;
- Maintaining at least 50 percent canopy closure; and
- Maintaining dense understories of small trees and other woody plants in forested areas.

Bay-breasted Warbler (*Dendroica castanea*)

Goal Description

The user wishes to create or enhance habitat for the bay-breasted warbler.

Species Information—Species information includes the following:

Range: Breeding—central Canada to northeastern New York, central Vermont and New Hampshire and southern Maine. Winter—central and eastern Panama to northern Colombia and western Venezuela.
Relative abundance in New England: Fairly common to rare.

Habitat: Breeding—northern coniferous or mixed forests, especially in young trees along ponds, streams, in bogs, or forest clearings.

Special habitat requirements: Early coniferous second growth of trees 1.8 to 3.4 m tall.

Nest site: Along a horizontal branch of a conifer or in the top of a small tree, usually 1.5 to 3 m out from trunk.

Foraging: Major foods—locusts, caterpillars, ants, beetles, leafhoppers, houseflies, and spiders. Substrates—foliage of trees at all heights but mainly in interior of tree tops. Techniques—searching and foliage gleaning with slow deliberate movements, often spending much time in same tree; occasionally hangs upside down; rarely hovers.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = balsam fir, spruce-fir, red spruce, or eastern hemlock, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Black-and-white Warbler (*Mniotilta varia*)

Goal Description

The user wishes to create or enhance habitat for the black-and-white warbler.

Species Information—Species information includes the following:

Range: Breeding—southern Canada, south to northern Mississippi, central Alabama, central Georgia, southern South Carolina, and southeastern North Carolina. Winter—from Baja, California, southern Texas, central Florida, and the Bahamas, south through Central America and the West Indies to northern South America.

Relative abundance in New England: Common.

Habitat: Breeding—Mature or second-growth deciduous or mixed woodlands from near sea level to mountain peaks; not abundant in northern coniferous forests.

Nest site: A depression in the ground at the base of a tree, stump or over-turned roots, rock or in the shelter of a log; usually hidden from above.

Sample densities: In Maryland, 21 territorial males per 40 ha in dense second growth; 13 territorial males per 40 ha in open slash area; 11 territorial males per 40 ha in virgin hardwood forest.

Foraging: Major foods—wood boring insects, click beetles, plant lice, small caterpillars, moths, spiders, egg masses, and pupae. Substrates—bark crevices of tree trunks and main branches, generally to 10.7 m high. Techniques—creeping and bark-gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, spruce-fir, or northern red oak, and
- Size class = regeneration, and
- Ground layer percent cover ≤ 30%, and
- Ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration or uneven-age, and
- Ground layer percent cover ≤ 30%, and
- Ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

OR

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Ground layer percent cover ≤ 30%, and
- Ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Not available.

Black-billed Cuckoo (*Coccyzus erythropthalmus*)

Goal Description

The user wishes to create or enhance habitat for the black-billed cuckoo.

Species Information—Species information includes the following:

Range: Breeding—Prince Edward Island, west to southeastern Alberta, south to South Carolina. Winter—northwestern South America.

Relative abundance in New England: Uncommon.

Habitat: Breeding—Brushy pastures, shrubby hedgerows at edges of fields, dry, open upland woods and groves.

Special habitat requirements: Low, dense, and shrubby vegetation.

Nest site: Usually low in shrub or on branch of deciduous or coniferous tree, well concealed among the leaves.

Foraging: Major foods—caterpillars (staple); also eats beetles, grasshoppers, crickets, and other insects; fond of fleshy fruits. Substrates—upper and lower leaf surfaces. Technique—leaf gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, balsam fir, spruce-fir, red spruce, northern red oak, or white pine, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- 15 < canopy closure ≤ 70%.

OR

- HAM forest type = white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- Shrub layer percent cover > 50%, and

- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- 15 < canopy closure ≤ 70%.

Treatment Implications

Not available.

Black-capped Chickadee (*Parus atricapillus*)

Goal Description

The user wishes to create or enhance habitat for the black-capped chickadee.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to central Alaska, south to North Carolina (mountains), northern New Mexico and northern California. Winter—Resident in breeding range.

Relative abundance in New England: Common.

Habitat: Breeding—deciduous, coniferous, or mixed woodlands (mixed preferred); frequents both heavily forested and residential areas. Winter—frequents city parks and residential areas with feeding stations adjacent to breeding habitat; birds generally remain in breeding areas.

Special habitat requirements: Require dead standing trees (minimum 10.2 cm dbh) for excavating cavities or trees with existing cavities for nesting; comparatively open situations (nesting) near deeper woods.

Nest site: In a cavity in a standing dead tree or stub, preferably birch, aspen, pin cherry, or other tree that undergoes rapid decay; accepts nest boxes; prefers stubs with firm shells and decayed interiors; usually excavated in decaying wood; rarely uses old woodpecker holes and natural cavities.

Territory size: Sizes ranged from 3.4 to 6.9 ha (average 5.3 ha) in different habitats; 0.9 ha for 1 pair in Kansas. Home Range—in winter, approximately 8.5 to 22.3 ha (average 14.6 ha) in New York; 7.7 ha in Kansas.

Sample densities: Average 1 pair per 8.9 ha in suitable habitat. Winter—1 bird per 1.1 ha in bottomland woods in New York; maximum 27 pairs per 40 ha.

Foraging: Major foods—insects, seeds, and fruits. Substrates—bark crevices; leaf, branch, and twig surfaces. Techniques—gleaning, probing of tree trunk, branches, and leaves. Preferred feeding habitat—chickadees feed where food is most abundant; birds fed more often in pine groves with abundant caterpillars than in adjacent oak woods.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Live cavity tree or dead cavity tree = present, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Black-throated Blue Warbler (*Dendroica caerulescens*)

Goal Description

The user wishes to create or enhance habitat for the black-throated blue warbler.

Species Information—Species information includes the following:

Range: Breeding—Northern Minnesota, east through Ontario, southern Quebec and Nova Scotia, south to Connecticut and the mountains of Georgia. Winter—West Indies.

Relative abundance in New England: Common.

Habitat: Breeding—Commonly found in or near mixed and deciduous forests with heavy undergrowth or at edges of woodland clearings generally in moist places.

Special habitat requirements: Woodlands with thick, shrubby undergrowth.

Nest site: In coniferous or deciduous trees, or in shrubs.

Sample densities: In Maryland, 58 territorial males per 40 ha in virgin hemlock forest; 48 territorial males per 40 ha in young second growth; 17 territorial per 40 ha in scrub spruce bog.

Foraging: Major foods—insects, mainly hairy caterpillars, moths, crane-flies, mosquitoes, and plant lice. Substrates—upper branches. Techniques—hawking, branch, and twig gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, and
- Size class = regeneration, sapling, or pole, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%.

OR

- HAM forest type = birch, balsam fir, red spruce, eastern hemlock, or northern red oak, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%.

OR

- HAM forest type = bottomland hardwoods, and
- Size class = sapling, pole, or small sawtimber, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%.

OR

- HAM forest type = spruce-fir, and
- Size class = small sawtimber, or large sawtimber, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%.

OR

- HAM forest type = white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and

- Canopy closure > 70%.

Treatment Implications

Not available

Black-throated Green Warbler (*Dendroica virens*)

Goal Description

The user wishes to create or enhance habitat for the black-throated green warbler.

Species Information—Species information includes the following:

Range: Breeding—central Canada to central New Jersey and south in the mountains to Alabama and Georgia. Winter—southern Texas and south central Florida, south to Greater Antilles, eastern Mexico to Panama.

Relative abundance in New England: Common.

Habitat: Breeding—usually in hemlocks, but sometimes in other northern conifers: pine, spruce, fir, and cedar; rarely in maples, birches, and other hardwoods.

Special habitat requirements: Coniferous or mixed woodlands.

Nest site: Usually on a horizontal or drooping branch.

Territory size: Size is 21 territories that ranged from 0.2 to 1.0 ha; average size 0.6 ha. Habitat—Hemlock-beech.

Sample densities: In Loud's Island, Maine, 71 pairs per 40 ha, 83% red spruce, 14% white spruce; 61 pairs per 40 ha in Marsh Island, Maine, 100% white spruce; 83 pairs per 40 ha in Harbor Island, Maine, 100% white spruce; 36 territorial males per 40 ha in mature oak-maple forest in Maryland; 9 territorial males per 40 ha in mature northern hardwoods forest.

Foraging: Major foods—insects, mainly leaf rollers, leaf-eating caterpillars, beetles, flies, gnats, and plant lice; also takes mites, cankerworms, spiders, and some berries. Substrates—often limbs and foliage of evergreen 3.0 to 15.0 m above ground. Techniques—hopping, rapid peering or hovering followed by gleaning, and occasional hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Deciduous midstory cover > 25%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Deciduous midstory cover > 25%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Blackburnian Warbler (*Dendroica fusca*)

Goal Description

The user wishes to create or enhance habitat for the Blackburnian warbler.

Species Information—Species information includes the following:

Range: Breeding—southern Canada to northwestern Connecticut, southeastern New York and northern New Jersey, south to the mountains of South Carolina. Winter—southern Central America, northern South America.

Relative abundance in New England: Common, especially in higher elevations.

Habitat: Breeding—deep coniferous woods or swampy woods where spruces are thickly draped with bearded lichen (Usnea); often associated with very tall hemlocks; also said to inhabit stands of second growth deciduous woods.

Special habitat requirements: Coniferous woodlands.

Nest site: High up in a tree (usually a spruce) situated well away from the trunk or in small fork near top of tree.

Territory size: Nine territories averaged 0.5 ha in size per pair in New York. Habitat—hemlock-beech.

Sample densities: In Loud's Island, Maine, 26 pairs per 40 ha, 83% red spruce, 14% white spruce; 17 pairs per 40 ha in Marsh Island, Maine, 100% white spruce; 100 territorial males per 40 ha in virgin hemlock forest in Maryland; 96 territorial males per 40 ha in virgin spruce-hemlock bog forest in Maryland; and 39 territorial males per 40 ha in scrub spruce bog in Maryland.

Foraging: Major foods—almost entirely insects such as beetles, caterpillars, ants, crane-flies. Substrates—high tree limbs. Techniques—passing from limb to limb with rapid gleaning, occasionally hovering or hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Canopy closure > 70%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, or eastern hemlock, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

OR

- HAM forest type = northern red oak, and
- Size class = small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Blackpoll Warbler (*Dendroica striata*)

Goal Description

The user wishes to create or enhance habitat for the blackpoll warbler.

Species Information—Species information includes the following:

Range: Breeding—edge of timber from northwestern and southern Alaska across to Newfoundland, south to southern Nova Scotia, and islands off eastern Maine; New England mountains. Winter—northern South America to eastern Brazil.

Relative abundance in New England: Common, local on Mt. Greylock (Massachusetts).

Habitat: Breeding—Among low coniferous trees at high elevations, often in swampy groves, in stunted spruce and fir on the upper slopes of mountains; favors small growth (stunted, young or medium-sized conifers).

Special habitat requirements: Low coniferous growth.

Nest site: Usually low in a spruce or other conifer; rarely on the ground.

Foraging: Major foods—insects such as spruce-gall lice, cankerworms, mosquitoes, fall webworms, locusts, ants, gnats; and some seeds and berries. Substrates—leaves and twigs. Techniques—foliage and gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Coniferous shrub layer cover > 0%, and
- Coniferous midstory cover > 25%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, or eastern hemlock, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coniferous shrub layer cover > 0%, and
- Coniferous midstory cover > 25%.

Treatment Implications

Not available.

Blue Jay (*Cyanocitta cristata*)

Goal Description

The user wishes to create or enhance habitat for the blue jay.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland west to southern Alberta, south to Florida and Texas. Winter—same as breeding range.

Relative abundance in New England: Common.

Habitat: Breeding—coniferous, deciduous, and mixed (preferred) woodlands representing a variety of forest types, wooded islands, farms, cities, suburbs, parks, and gardens; prefers woodlands of oak, beech, and hickory. Winter—some northern birds move to more southern parts of breeding range.

Nest site: Prefers to nest in conifer thickets in mixed woodlands; also builds in deciduous trees, shrubs, and shrubs overrun with vines; nest may be close to trunk of tree or well out on a horizontal limb.

Territory size: Territorial boundaries are not well defined.

Sample densities: In Maryland, 5 birds per 40 ha in well defined floodplain forest; also in Maryland, 4 birds per 40 ha in mixed-oak forest.

Foraging: Major foods—seeds, fruits, mast, occasionally takes insects, nestlings, young mice; acorns are a staple food item throughout the year. Substrates—ground (litter), tree tops, shrubs; birds feed at all levels in vegetation. Techniques—hopping and gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Deciduous midstory cover > 25%, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Blue-gray Gnatcatcher (*Polioptila caerulea*)

Goal Description

The user wishes to create or enhance habitat for the blue-gray gnatcatcher.

Species Information—Species information includes the following:

Range: Breeding—southern New England, western Pennsylvania, west to northeastern California, south to southern Mexico. Winter—South Carolina south through the coastal states to southern California, south to Central America.

Relative abundance in New England: Rare (Maine).

Habitat: Breeding—open, moist woodlands interspersed with brushy clearings, often oak, pine, or mixed woods, bottomland forests with closed canopies, wooded swamps, and stream-side thickets; favors tall trees.

Special habitat requirements: An abundant supply of arthropods.

Nest site: Usually high in a deciduous or coniferous tree saddled on a horizontal limb or in a fork; nests in a variety of trees (limb size and shape seem to be more important than tree species).

Territory size: Nine territories range from 0.9 to 3.0 ha averaged 1.8 ha in oak woodland and chaparral in California; one territory covered 0.9 ha along a wooded ravine and grove of trees in Kansas.

Sample densities: In Maryland, 7 pairs per 40 ha in semi-open floodplain forest; 6 pairs per 40 ha in unsprayed orchard.

Foraging: Major foods—apparently feeds exclusively on arthropods, primarily insects. Substrates—tips of branches, leaf surfaces, and bark. Techniques—hawking, hover-gleaning, twig, and leaf gleaning. Preferred feeding habitat—high canopy of forest trees.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, and
- Size class = sapling or pole, and
- 30 < canopy closure ≤ 70%.

OR

- HAM forest type = birch, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- 30 < canopy closure ≤ 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- 30 < canopy closure ≤ 70%.

Treatment Implications

Not available.

Blue-winged Warbler (*Vermivora pinus*)

Goal Description

The user wishes to create or enhance habitat for the blue-winged warbler.

Species Information—Species information includes the following:

Range: Breeding—southern Wisconsin, southern Michigan, northern Ohio, western Pennsylvania, western and southeastern New York, southern New England, south to southern Illinois, central Tennessee, Kentucky, northern Alabama, northern Georgia, North Carolina, northern Virginia, northeastern Maryland, Delaware. Winter—from southern Mexico to Guatemala, and Nicaragua and casually to Panama and Colombia; also western Cuba.

Relative abundance in New England: Uncommon to locally common.

Habitat: Breeding—edges of woods, bushy overgrown fields or borders of wooded swamps; prefers old fields with saplings greater than 10 ft tall.

Special habitat requirements: Old fields with scattered shrubs and small trees.

Nest site: On the ground on a foundation of dry leaves, surrounded by bushes or tangle of vines and grasses.

Territory size: Less than 0.4 ha to almost 0.8 ha per pair (New York); Burke Lake, Michigan (2.0 ha per pair) habitat—an extensive tamarack swamp surrounded by higher, drier oak-hickory woods: Island Lake, Michigan (1.3 ha per pair) habitat—a low swamp of tamarack, poison sumac, red osier and gray dogwoods and poplars.

Foraging: Major foods—caterpillars, beetles, ants, and spiders. Substrates—branches at tops of trees. Techniques—twig and leaf gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Shrub layer percent cover > 50%.

Treatment Implications

Not available.

Broad-winged Hawk (*Buteo platypterus*)

Goal Description

The user wishes to create or enhance habitat for the broad-winged hawk.

Species Information—Species information includes the following:

Range: Breeding—throughout the eastern United States from southern Canada to the Gulf States. Winter—southern tip of Florida, south.

Relative abundance in New England: Common to uncommon.

Habitat: Breeding—dry forests (mostly deciduous and mixed, occasionally in conifers), wooded hillsides generally away from human habitations; prefers continuous woods, shuns open country; seems to prefer to nest along untraveled woods roads, at least in New England.

Special habitat requirements: Extensive woodlands.

Nest site: Shows little preference for kind of nest tree—generally choosing one of the largest and most abundant species; typically locates nest in crotch next to trunk; 14 trees supporting nests in deciduous woods in New York had a mean dbh of 54.1 cm (range 42.1 to 74.2 cm); the hawks showed a preference for nesting in yellow birch.

Foraging: Major foods—amphibians, reptiles, insects, small mammals such as shrews (staple) and mice, occasionally takes young birds. Substrate—forest floor. Techniques—hawking, soaring, diving, and pouncing. Preferred feeding habitat—prefers deep, shady woodlands, sometimes ventures out over meadows.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, eastern hemlock, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration, small sawtimber, large sawtimber, or uneven-age, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Brown Creeper (*Certhia americana*)

Goal Description

The user wishes to create or enhance habitat for the brown creeper.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west through the southern Canadian provinces to Alaska, south to Maryland (locally), the mountains of North Carolina and the Rockies. Winter—northern United States, south to Florida, the Gulf Coast, and central Texas.

Relative abundance in New England: Locally common to uncommon.

Habitat: Breeding—Dense coniferous, deciduous, or mixed woodlands, wooded swamps. Winter—same but birds retreat to lower altitudes.

Special habitat requirements: Standing dead trees with loose bark; the minimum dbh of suitable nest trees is 25.4 cm.

Nest site: Low on trunk of coniferous or deciduous tree under a strip of loose bark, less often in a rotted knothole or old woodpecker cavity (probably only when loose bark is unavailable).

Foraging: Major foods—insects; a small amount of vegetable material, mainly mast. Substrates—bark crevices, trunk, sides and undersides of limbs. Techniques—gleaning, probing, and scaling. Preferred feeding habitat—sometimes attracted to suet at feeding stations in winter.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = northern red oak, or white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present.

Treatment Implications

Not available.

Brown Thrasher (*Toxostoma rufum*)

Goal Description

The user wishes to create or enhance habitat for the brown thrasher.

Species Information—Species information includes the following:

Range: Breeding—Maine west to southern Alberta, south to Florida and the Gulf Coast. Winter—Long Island and coastal sections of New Jersey, south to Maryland, coastal and inland Virginia to Missouri south to Florida and Texas.

Relative abundance in New England: Common (Maine).

Habitat: Breeding—bushes, low trees, tangle of vines in open pastures or woodland edges and clearings in early stages of second growth; hedgerows along roadsides and fields are preferred;

absent from higher mountains of New England. Winter—coastal areas where climate is mild and sparse snow cover allows birds to find fruits.

Special habitat requirements: Low, dense woody vegetation for nesting and cover.

Nest site: On ground or low in dense cover of a shrub or vine; less often in a low tree.

Territory size: Average 0.6 ha in forest edge in Illinois.

Sample densities: Density includes 3 pairs per 40 ha in forest edge; 189 birds per 40 ha in hedgerows and 76 birds per 40 ha in edge shrubbery; 86 birds per 40 ha in second-growth or cut-over woods.

Foraging: Major foods—insects (about 66%); berries, mast (acorns), and grain (about 33%). Substrates—leaf litter, soft earth, and low vegetation. Techniques—ground and shrub gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Soft mast = present.

OR

- HAM forest type = bottomland hardwoods, and
- Size class = regeneration, sapling, or pole, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Soft mast = present.

Treatment Implications

Not available.

Brown-headed Cowbird (*Molothrus ater*)

Goal Description

The user wishes to create or enhance habitat for the brown-headed cowbird.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to British Columbia, south to Virginia, Louisiana and Mexico. Winter—coastal sections of Massachusetts, south to central Florida, Ohio River Valley, west to northern California, south to Mexico.

Relative abundance in New England: Common.

Habitat: Breeding—open coniferous and deciduous woodlands, forest edges, agricultural land, suburban areas. Winter—agricultural lands, feeding stations.

Nest site: Parasitic, builds no nest; lays eggs in nests of other birds (214 species of which 121 have raised young cowbirds successfully); song sparrows and yellow warblers are most common hosts.

Territory size: Apparently does not defend an area but has a fixed breeding area in which female lays eggs.

Home range: About 8.1 to 12.1 ha in floodplain habitat (open weedy fields with scattered trees) in Ohio.

Sample densities: Sample includes 59 pairs per km^2 in favorable habitat in North Dakota.

Foraging: Major foods—seeds of weeds, grasses, grains, and insects. Substrates—short grasses, soft earth, and weeds. Technique—ground gleaning. Preferred feeding habitat—grain fields, pastures where they often feed among cattle.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- High perch = present, and
- Low perch = present.

Treatment Implications

Not available.

Canada Warbler (*Wilsonia canadensis*)

Goal Description

The user wishes to create or enhance habitat for the Canada warbler.

Species Information—Species information includes the following:

Range: Breeding—southern Canada to northern New Jersey and southeastern New York, south in the mountains to Georgia; rarely to southern New England coast. Winter—Central and South America.

Relative abundance in New England: Common (Maine and elsewhere at higher elevations).

Habitat: Breeding—Occupies a variety of habitats from lowlands to uplands, coniferous to deciduous; favors shrubby undergrowth in cool, moist, mature woodlands, aspen and cherry "burns," streamside thickets, cedar bogs, weedy ravines and, less often, dry forest edge with young trees.

Nest site: On or near the ground, atop mossy logs or stumps, cavities in banks or amid roots of wind throws, among fern stands; nests are usually in the vicinity of a stream, pond, or other body of water.

Territory size: One male occupied a singing area of 0.2 ha until nesting began, at which time he expanded his movements to 0.8 ha; another male roamed 1.2 ha after nesting began (New York).

Sample densities: In Maryland, 45 territorial males per 40 ha in dense oak-maple second growth; 32 territorial males per 40 ha in young second-growth (after cutting); 21 territorial males per 40 ha in open hemlock-spruce bog.

Foraging: Major foods—mosquitoes, flies, moths, beetles, small hairless caterpillars, and spiders. Substrates—air and leaf litter. Techniques—hawking and ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer, or coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

OR

- Size class = regeneration, small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft3/ac (3.5 m3/ha), and
- Deciduous shrub layer, or coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer, or coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Not available.

Cape May Warbler (*Dendroica tigrina*)

Goal Description

The user wishes to create or enhance habitat for the Cape May warbler.

Species Information—Species information includes the following:

Range: Breeding—central and eastern Canada, south to northern Wisconsin, northeastern New York, northern New Hampshire and northern Maine. Winter—West Indies, north to the Bahamas.

Relative abundance in New England: Common (Maine).

Habitat: Breeding—fairly open coniferous forest with a high percentage of mature spruces; dense spruce forest with a scattering of taller spires above the canopy level; in more open land among small trees.

Special habitat requirements: Tall stand of spruce.

Nest site: Usually in top of a coniferous tree.

Sample densities: Sample includes 28 pairs per 40 ha spruce-fir forest near Lake Nipigon, Ontario.

Foraging: Major foods—insects, ants, small adults and larvae of moths, flies, beetles, small crickets, termites, and larvae of dragonflies; also takes spiders. Substrates—tips of dense branches and new buds of firs and spruces near tops of trees. Techniques—gleaning and hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = balsam fir, or red spruce, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

OR

- HAM forest type = spruce-fir, and
- Canopy closure > 70%.

OR

- HAM forest type = white pine, and
- Size class = sapling, pole, or small sawtimber, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Carolina Chickadee (*Parus carolinensis*)

Goal Description

The user wishes to create or enhance habitat for the Carolina chickadee.

Species Information—Species information includes the following:

Range: Occurs throughout Pennsylvania except in the Central Lowlands and New England Provinces down to central Florida, Gulf Coast, Oklahoma, southeastern Kansas; also in southern midwestern states; does not occur in New England.

Relative abundance in New England: Fairly common.

Habitat: Breeding—Deciduous, coniferous, or mixed forests; frequents both heavily forested and residential areas.

Special habitat requirements: Dead trees for excavating cavities or trees with existing cavities for nesting; soft and hard mast.

Nest site: Unreported.

Territory size: Unreported.

Home range: Unreported.

Sample densities: Unreported.

Foraging: Insects, seeds, and fruits.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, Piedmont Plateau, or Coastal Plain, and
- Live cavity tree or dead cavity tree = present, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Carolina Wren (*Thryothorus ludovicianus*)

Goal Description

The user wishes to create or enhance habitat for the Carolina wren.

Species Information—Species information includes the following:

Range: Breeding—southern New England, central New York (except mountains), west to southeastern Wisconsin and Iowa, south to the Gulf Coast and Mexico. Winter—same as breeding range.

Relative abundance in New England: Rare (Massachusetts).

Habitat: Breeding—a variety of places from lowland stream bank tangles to upland brushy slopes, woodland edges, slash piles, and in the vicinity of buildings; prefers moist areas. Winter—low, flat ground near tidewater creeks; narrow valleys and deep ravines in parts of winter range; wrens in Ohio moved from partly exposed areas to sheltering woodlands in extremely cold weather.

Special habitat requirements: Low brushy vegetation.

Nest site: Commonly nests in a cavity in a variety of places both natural and manmade; less often builds a matted ball of sticks in a low shrub or in grasses that has a side entrance and central cavity.

Territory size: Wrens occupied a wooded ravine-pond habitat in Kansas for 4 years and defended the following areas: 2.3, 3.7, 1.6, and 3.1 ha; average 0.1 ha in a swamp-thicket in Illinois.

Sample densities: In Maryland, 11 territorial males per 40 ha in hardwood forest (oaks, yellow-poplar) with scattered pine; 6 territorial males per 40 ha in well-drained flood-plain forest.

Foraging: Major foods—insects, occasionally takes wild fruits. Substrates—trunks of trees, branches of shrubs, leaf surfaces, and ground litter. Techniques—tree, shrub, leaf gleaning, and creeping.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer cover > 0%.

Treatment Implications

Not available.

Cedar Waxwing (*Bombycilla cedrorum*)

Goal Description

The user wishes to create or enhance habitat for the cedar waxwing.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to British Columbia, south to Georgia, New Mexico and northern California. Winter—Central New England, west to Oregon, south to Central America.

Relative abundance in New England: Locally common to uncommon.

Habitat: Breeding—open deciduous and coniferous woodlands (avoids dense forests), orchards, shade trees; semi-open country, commonly in agricultural areas and near water. Winter—same as breeding habitat.

Nest site: Prefers dense coniferous thickets (often cedar) but nests in a variety of deciduous trees and shrubs; nest is placed on a horizontal limb, often in a crotch next to main trunk.

Territory size: Three territories on an island in Lake Erie had the following areas: 0.02, 0.2, and 0.09 ha.

Sample densities: In Michigan, 20 nests were found in a 0.9 ha white pine plantation; 11 nests were located within a radius of 7.6 m in Ontario; 16 pairs per 40 ha in open hemlock-spruce bog in Maryland.

Foraging: Major foods—fresh and dried fruits and flowers (80%) and insects (20%). Substrates—leaf surfaces and fruit-bearing branches. Techniques—gleaning and hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, and
- Size class = regeneration, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Soft mast = present.

OR

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Soft mast = present.

OR

- HAM forest type = spruce-fir, and
- Size class = small sawtimber, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Soft mast = present.

OR

- HAM forest type = white pine, and
- Size class = regeneration, sapling, pole, or small sawtimber, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Soft mast = present.

Treatment Implications

Not available.

Cerulean Warbler (*Dendroica cerulea*)

Goal Description

The user wishes to create or enhance habitat for the Cerulean warbler.

Species Information—Species information includes the following:

Range: Breeding—In the east from southeastern Ontario and central New York, and south; also found in Sandbar State Park, Vermont. Winter—South America.

Relative abundance in New England: Locally common at low elevations in the Champlain Valley.

Habitat: Breeding—swamps and bottomlands; favors open stands of tall trees along riverbanks or dense deciduous forests with little undergrowth; generally occupies upper canopy.

Special habitat requirements: Tall deciduous trees.

Nest site: Usually in the fork of a tall tree, some distance from the trunk with an open area below; elm was a favorite nest tree in New York State.

Sample densities: Sample includes 4.8 territorial males per 20 ha in birch-basswood habitat in Pennsylvania.

Foraging: Major foods—mainly insects such as wasps, ants, bees, beetles, weevils, and caterpillars. Substrates—air and leaves. Techniques—hawking and foliage gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, or white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Chestnut-sided Warbler (*Dendroica pensylvanica*)

Goal Description

The user wishes to create or enhance habitat for the chestnut-sided warbler.

Species Information—Species information includes the following:

Range: Breeding—southern Canada south through mountainous uplands to eastern Tennessee and northern Georgia. Winter—Central America.

Relative abundance in New England: Common.

Habitat: Breeding—Second growth woodland edges and abandoned fields; along brushy brook sides and hillsides, roadside thickets, woodland clearings, and burns.

Special habitat requirements: Early second growth, sprouts and bush at wood margins, hardwood regeneration.

Nest site: Well concealed in low bush, sapling, briars, or vines.

Territory size: Prior to mating, four territories measured 0.5, 0.5, 0.5, 1.0 ha. During incubation, males increased territory size by 61 to 213.4 m to encompass 0.8 to 4.9 ha in New York.

Sample densities: In Maryland, 79 territorial males per 40 ha in dense second growth; 67 territorial males per 40 ha in open slash (oak-maple) area.

Foraging: Major foods—beetles, caterpillars, plant lice, leaf hoppers, ants, and spiders. Substrates—foliage of shrubs or low plants to 10.7 m tall. Techniques—hopping along branches and gleaning foliage.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, or birch, and
- Size class = regeneration, sapling, or pole, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%.

OR

- HAM forest type = northern hardwoods, or bottomland hardwoods, and
- Size class = regeneration, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%.

Treatment Implications

Treatments may include the following:

- Maintaining deciduous forest conditions; and
- Maintaining brushy areas with no canopy.

Chipping Sparrow (*Spizella passerina*)

Goal Description

The user wishes to create or enhance habitat for the chipping sparrow.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to the Yukon, south to Georgia and Central America. Winter—southern Maryland, west to Texas and southern California, and south.

Relative abundance in New England: Common.

Habitat: Breeding—Suburban residential areas, farms, orchards, open mixed woodlands, clearings in forests and woodlands edges, borders of lakes and streams.

Nest site: In a tree, shrub or vine; rarely on ground; nest is often low in ornamental evergreen, typically well concealed.

Territory size: In Michigan, 0.4 to 0.6 ha in residential area; 0.3 ha in Michigan; 3.1 ha in South Carolina.

Sample densities: In Maryland, 90 territorial males per 40 ha in suburban residential area with orchard and lawn; 48 territorial males per 40 ha in unsprayed apple orchard; 18 territorial males per 40 ha in mixed agricultural habitats, including hedgerows and wood margins.

Foraging: Major foods—insects and seeds; March through November diet 38% animal; 62% vegetable. Substrates—weeds and grasses. Technique—ground gleaning. Preferred feeding habitat—areas with abundant weeds.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = white pine, and
- Size class = large sawtimber, and
- Shrub layer percent cover > 20%, and
- 15 < canopy closure ≤ 30%, and
- Low perch = present.

OR

- Size class = regeneration, sapling, or pole, and
- Shrub layer percent cover > 20%, and
- 15 < canopy closure ≤ 30%, and
- Low perch = present.

Treatment Implications

Not available.

Common Grackle (*Quiscalus quiscula*)

Goal Description

The user wishes to create or enhance habitat for the common grackle.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to the southern Canadian Rockies, south to Florida, the Gulf Coast and Texas. Winter—coastal sections of southern New England southern Ohio River Valley and Kansas, and south.

Relative abundance in New England: Abundant in breeding season; uncommon in winter.

Habitat: Breeding—farmlands, suburbs, marshes, swamps, and meadows at low elevations; uncommon in mountains. Winter—agricultural areas with or without open water and some bare ground.

Nest site: Solitary or colonial nesters; usually nests in small colonies of 20 to 30 pairs; prefers conifers but uses deciduous trees and shrubs; less frequently nests in cavities, rock ledges, or cattails.

Territory size: Both male and female defend a small area surrounding nest.

Home range: Grackles range a mile or more from the nest site.

Sample densities: In North Dakota, 35 pairs per km^2 in favorable habitat.

Foraging: Major foods—ground-dwelling insects, fruits, mast, waste grains, small quantities of fish, crustaceans, amphibians, nesting birds and eggs. Substrates—mud, cultivated earth, and short grasses. Techniques—ground gleaning and probing. Preferred feeding habitat—open field, shores of ponds, and lawns.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, northern red oak, or white pine/red oak/ red maple, and

- Size class = regeneration, and
- Permanent ponds or streams = present, and
- Ground layer percent cover > 75%, and
- Ericaceous shrub layer cover > 0%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = bottomland hardwoods, and
- Size class = regeneration, sapling, pole, or small sawtimber, and
- Permanent ponds or streams = present, and
- Ground layer percent cover > 75%, and
- Ericaceous shrub layer cover > 0%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = white pine, and
- Permanent ponds or streams = present, and
- Ground layer percent cover > 75%, and
- Ericaceous shrub layer cover > 0%, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Common Raven (*Corvus corax*)

Goal Description

The user wishes to create or enhance habitat for the common raven.

Species Information—Species information includes the following:

Range: Breeding—northern North America, south to coastal Maine, the Dakotas, and the mountains to Georgia and Central America; local in Adirondack Mountains. Winter—some birds move to more southern parts of breeding range.

Relative abundance in New England: Common (Maine).

Habitat: Breeding—Remote mountain forests, seacoasts, and wooded marine islands; prefers open woodlands, clearings; avoids extensive, and dense forests. Winter—Ravens commonly move toward the coast or to southern parts of breeding range where food is more accessible; lake shores, river banks, and mudflats.

Special habitat requirements: Cliffs or tall trees for nesting.

Nest site: Usually on a cliff or high in a coniferous tree; ravens in Virginia nested on cliffs with an overhang above and a steep rock face below; nests were found as close as 0.8 km to human dwellings.

Home range: In Wyoming, 6.7 to 10.9 km^2 (observed areas); ravens observed flying more than 2 km from nest sites.

Sample densities: Nests are often space several miles apart; others have found ravens nesting as close as 2.2 km and with an average distance of 4.3 km.

Foraging: Major foods—ravens are omnivorous, taking small to large mammals (carrion), birds, insects, and plant material. Substrates—lake shores, mud flats (coast), and forest floor. Technique—scavenging. Preferred feeding habitat—seabird colonies (coast), garbage heaps, and highways (road kills).

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, or bottomland hardwoods, and
- Size class = regeneration, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, or Blue Ridge, and
- Soft mast or hard mast = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration, small sawtimber, large sawtimber, or uneven-age, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, or Blue Ridge, and
- Soft mast or hard mast = present.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, northern red oak, white pine/red oak/red maple, or white pine, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, or Blue Ridge, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Common Yellowthroat (*Geothlypis trichas*)

Goal Description

The user wishes to create or enhance habitat for the common yellowthroat.

Species Information—Species information includes the following:

Range: Breeding—from southeastern Alaska to northern Alberta and Newfoundland south to northern Baja California, Mexico, and southern Texas, the Gulf Coast and southern Florida. Winter—along the Pacific Coast, from northern California across southern Arizona, central Texas, and southern Arkansas to the Gulf States, and along the Atlantic Coast from New Jersey, Virginia, and Delaware to Florida; also in the Bahamas, West Indies, Mexico, and Central America.

Relative abundance in New England: Common to abundant.

Habitat: Typically inhabits areas with a mixture of dense, lush herbaceous vegetation with small woody plants (mainly shrubs and small trees), in damp or wet situations; occasionally found in dry thickets or dense undergrowth in open woodlands.

Special habitat requirements: Dense growth of low vegetation.

Nest site: Builds a bulky cup nest of grass, leaves, and bark, well hidden on the ground in a grass tussock or similar vegetation; occasionally locates nest in shrubs or a tangle of briars up to 3 ft above the ground.

Territory size: Unreported.

Sample densities: Unreported.

Foraging: Gleans insects and spiders from leaves of shrubs, grasses, and forbs.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Ground layer percent cover > 75; or
- Shrub layer percent cover > 50.

Cooper's Hawk (*Accipiter cooperii*)

Goal Description

The user wishes to create or enhance habitat for the Cooper's hawk.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia west to western Ontario, south to Florida and the Gulf Coast. Winter—Southern New England and Ohio, south to Central America.

Relative abundance in New England: Uncommon in winter (Massachusetts) to rare (Maine) in breeding season.

Habitat: Breeding—extensive deciduous or mixed woodlands that are dense or open, scattered woodlots interspersed with open fields; occupies similar forest niche as sharp-shinned hawk but has broadened its habitat by moving into more open agricultural areas; floodplain forests and wooded swamps. Winter—similar to breeding habitat.

Nest site: In a conifer (often white pine), but more often in a hardwood tree; nest is commonly placed on a horizontal branch or in a crotch near the trunk; frequently uses old crow nests; Cooper's hawks often return to same nest site year after year.

Home range: In Michigan, 0.2 km^2 to 5.3 km^2; average winter range 2.4 to 3.2 km in diameter.

Sample densities: In Maryland, 0.2 pairs per 40 ha in mixed forest-farmland habitat.

Foraging: Major foods—small to medium birds and small mammals, especially rodents and young lagomorphs; occasionally eats insects and amphibians. Substrates—forest floor and meadow grasses. Techniques—hawking, diving to ground, and pouncing. Preferred feeding habitat—Cooper's hawks hunt primarily in woodlots away from nest area and in open areas near woodland.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Canopy closure ≤ 15%; or
- Canopy closure > 30% and ≤ 70%.

Treatment Implications

Not available.

Dark-eyed Junco (*Junco hyemalis*)

Goal Description

The user wishes to create or enhance habitat for the dark-eyed junco.

Species Information—Species information includes the following:

Range: Breeding—Quebec, west to Alaska, south to central New England, Georgia (mountains), northern Minnesota and southern Yukon. In the west, south to the mountains of southwestern United States. Winter—throughout most of the United States except the Florida peninsula and the extreme northern parts of breeding range.

Relative abundance in New England: Common to uncommon.

Habitat: Breeding—coniferous and mixed forests, forest edges, borders of steams, woodland clearings, and sides of logging roads. Winter—areas with conifers for night roosting; juncos preferred open weedy fields and used mature deciduous and coniferous woods infrequently; hedgerows and brushy field borders.

Nest site: Often on ground under weeds and grasses, on slope, under fallen log or at base of tree or roadbank in cavity formed by roads; occasionally nests low in shrub or tree.

Home range: Ranges are 27, 33, and 17 ha for two flocks (one flock used two home ranges).

Foraging: Major foods—insects, wild fruits, and weed seeds. Substrates—grasses, leaf litter, and weeds. Technique—Ground gleaning. Preferred feeding habitat—weed patches and hedgerows.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Ground layer percent cover > 75%, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%.

Treatment Implications

Not available.

Downy Woodpecker (*Picoides pubescens*)

Goal Description

The user wishes to create or enhance habitat for the downy woodpecker.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to northwestern Alaska, south to Florida and New Mexico. Winter—same as breeding range.

Relative abundance in New England: Common.

Habitat: Breeding—interior and edges of open mixed woodlots and forests (prefers bottomlands), orchards, shade trees in towns, and suburbs; prefers habitat with living and dead medium-sized trees 25.4 to 55.9 cm dbh; high correlation between downy distribution and sapling density, indicating that sapling removal may decrease downy habitat. Winter—bottomland forest, shrub habitat, upland areas with large trees, and forest edges; birds on high mountains move to lower elevations.

Special habitat requirements: Trees greater than 15.2 cm dbh for nesting.

Nest site: Cavity in living or dead tree, in sound or rotting wood, stump, often on underside on limb; nests found in trees 20 to 30 cm dbh; prefers to nest in open woodlands in upper parts of dead trees; cavity excavated for courtship activity and nesting; a separate cavity is excavated in fall for winter roosting; often re-excavates same tree year after year.

Territory size: In Illinois, 0.5 to 1.3 ha (average 0.8 ha) for 9 pairs in mature lowland forest.

Home range: In Ontario, 2.0 to 3.2 ha is estimated size for 2 pairs in second-growth forest.

Sample densities: In Illinois, 36 birds per 40 ha in virgin floodplain forest; maximum of 13 pairs per 40 ha.

Foraging: Major foods—insects, especially wood-boring ants and beetle larvae. Substrates—bark crevices, trunks and branches of living and dead trees, and under loose bark. Techniques—scaling, drilling, probing, gleaning, flight-gleaning, and hawking. Preferred feeding habitat—woodlands with elms and oaks; downies generally feed on lower branches and trunk.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Dead cavity tree = present, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Treatments may include the following:

- Maintaining low stand stocking;
- Maintaining an average diameter of at least 6 inches dbh;
- Maintaining snags at least 6 inches in dbh; and
- Maintaining dense understories.

Eastern Bluebird (*Sialia sialis*)

Goal Description

The user wishes to create or enhance habitat for the eastern bluebird.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland west to southern Manitoba, south to Florida, the Gulf Coast and Central America. Winter—southern New England west to southern Michigan, and south.

Relative abundance in New England: Uncommon to rare.

Habitat: Breeding—open country with scattered trees (savannas), farmlands, open woods, swamps, sparsely inhabited residential areas, roadside fence lines, woodland edges beside fields and meadows, orchards, clearings created by fire, flood, or logging; clearcuts with standing, cavity bearing snags provided bluebird nesting habitat for at least 12 years following cutting. Winter—bluebirds in Illinois favored grasslands, shrub areas, and forest edges in winter.

Special habitat requirements: Low cavities for nesting; abundant perches for foraging.

Nest site: Natural cavities, old woodpecker holes, or nest boxes.

Territory sizes: In Kansas, 2.2, 3.5, and 2.8 ha for three territories; 1.0 ha.

Home range: Foraging areas, 4.5 to 38.9 ha during the nesting period.

Sample densities: In Illinois, 30 birds per 40 ha in orchard; 34 birds per 40 ha in edge shrubbery in Illinois; 25 birds per 40 ha in residential habitat in Illinois; 13 birds per 40 ha in second-growth or cutover woods in Illinois.

Foraging: Major foods—insects, especially grasshoppers, crickets, beetles, and caterpillars, make up about 68% of diet; fruit represents about 32% of diet. Substrates—leaf and branch surfaces,

leaf litter on ground, and air. Techniques—Gleaning, flight-gleaning, dropping to ground from perch, and hawking. Preferred feeding habitat—areas with poor soil and sparse ground cover.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Live cavity tree or dead cavity tree = present, and
- Canopy closure ≤ 30%.

OR

- HAM forest type = white pine, and
- Ground layer percent cover > 75%, and
- Live cavity tree or dead cavity tree = present, and
- Canopy closure ≤ 30%.

Treatment Implications

Treatments may include the following:

- Maintaining areas with seedling-sized trees;
- Maintaining other open areas; and
- Maintaining low perches and snags or fence posts.

Eastern Kingbird (*Tyrannus tyrannus*)

Goal Description

The user wishes to create or enhance habitat for the eastern kingbird.

Species Information—Species information includes the following:

Range: Breeding—New Brunswick, west to southwestern British Columbia, south to Florida, New Mexico, and Oregon. Winter—Central and South America.

Relative abundance in New England: Common.

Habitat: Breeding—Frequently in orchards, pastures, and shrubby borders, forest edges, along fields and highways, near streams with shrubby banks, swamps or marshes with dead stumps and snags, and sometimes in open woodlands.

Special habitat requirements: Open situations and perches for flycatching.

Nest site: Usually on a tree limb quite far from trunk and often over water; less commonly nests in a crotch or on top of dead stub; apple is a preferred nest tree.

Territory size: 5.7 to 14.2 ha (4 pairs).

Sample densities: Approximately 2 to 9 birds per 40 ha in suitable habitat in Illinois; 4 pairs per km^2 (maximum density) in North Dakota; 10 pairs per 40 ha in residential-orchard-lawn habitat in Maryland.

Foraging: Major foods—flying insects (staple), wild fruits; consumes over 200 kinds of insects and more than 40 kinds of fruits. Substrate—air. Techniques—hawking, hovering, and flight-gleaning; birds seem to have favorite hawking perches. Preferred feeding habitat—over open land or water.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

-
- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 30%, and
- Low perch = present.

Treatment Implications

Not available.

Eastern Phoebe (*Sayornis phoebe*)

Goal Description

The user wishes to create or enhance habitat for the eastern phoebe.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to Alaska, south to northern Georgia (mountains) and eastern New Mexico. Winter—Maryland south; rarely to southern New England (coast) and Long Island.

Relative abundance in New England: Common.

Habitat: Breeding—woodland cliffs, ravines, agricultural and suburban areas, often near streams.

Special habitat requirements: Perches 1.5 to 4.6 m high; cliffs or ledges at stream-side clearings or manmade structures at forest openings.

Nest site: On a ledge, usually sheltered above by an overhang, often under leaves or on window ledges, barn beams, and bridge girders; nest is frequently near water; birds are very adaptable in nesting habits.

Territory size: In Kansas, 1.3 to 2.9 ha for two pairs nesting on buildings; 0.3 ha in an Illinois floodplain forest.

Sample densities: In Illinois, 6 nests per 12.1 ha in optimum habitat; 7 pairs per 40 ha in mixed agricultural habitats in Maryland; 0.6 pairs per 40 ha in mixed forests and fields in Maryland.

Foraging: Major foods—flying insects and occasionally small fruits. Substrate—air. Technique—hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = small sawtimber, and
- Low perch = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber or uneven-age, and
- Low perch = present.

OR

- Size class = large sawtimber, and
- Low perch = present.

Treatment Implications

Not available.

Eastern Screech-owl (*Otus asio*)

Goal Description

The user wishes to create or enhance habitat for the eastern screech-owl.

Species Information—Species information includes the following:

Range: Breeding—New Brunswick, west to southern Alaska, south to the Florida Keys and central Mexico. Winter—same as breeding range.

Relative abundance in New England: Uncommon (Massachusetts) to rare (Maine).

Habitat: Breeding—shade trees in towns, orchards, small woodlots, and open woodlands. Winter—same as breeding habitat.

Special habitat requirements: Cavities for nesting and roosting in trees with a minimum dbh of 30.5 cm.

Nest site: Natural cavities and abandoned woodpecker holes, especially those of the flicker and pileated woodpecker; cavities are also used for roosting and caching food.

Territory size: Variable; adjacent territories are usually separated by an undefended area.

Sample densities: In Michigan, 1 pair per 6.5 km^2; in Wyoming, 1 pair per 10.4 km^2.

Foraging: Major foods—rodents (especially meadow mice) and insects are staples; crayfish, snails, reptiles, amphibians, birds, and fish are also taken. Substrates—forest floor and meadow grasses. Techniques—swooping and pouncing. Preferred feeding habitat—grassy openings among widely spaced trees, open fields, meadows, or in New England, along wooded field margins or streams.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, bottomland hardwoods, balsam fir, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Live cavity tree or dead cavity tree = present, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Not available.

Eastern Wood-pewee (*Contopus virens*)

Goal Description

The user wishes to create or enhance habitat for the eastern wood-pewee.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia west to southern Manitoba, south to Florida and Texas. Winter—Central and South America.

Habitat: Breeding—interior and edge of deciduous and coniferous forest, bottomlands, uplands, farm woodlots, roadside, and parks; seems to be strongly associated with oaks, but occurs in more northern forests as well; probably requires predominance of hardwoods; occur in deciduous woodlands with relatively open understories; nests are usually associated with openings; nest in a forest with a dense understory if canopy above is incomplete or sparse.

Nest site: Typically saddled on horizontal limb of tree usually far from trunk; sometimes on dead limb of living tree.

Territory size: In Illinois, 0.6 to 1.3 ha in lowland forest.

Home range: Range is 4.4 ha.

Sample densities: In Maryland, 19 pairs per 40 ha in virgin hardwood forest; 7 pairs per 40 ha in unsprayed apple orchard; 6 pairs per 40 ha in upland oak forest; 5 pairs per 40 ha in pine-oak forest.

Foraging: Major foods—insects. Substrates—leaf surfaces, air. Techniques—hawking, flight-gleaning, and gleaning. Preferred feeding habitat—woodland clearings, edges of fields, and marshes; generally feeds in mid to lower tree canopy.

Desired Future Conditions
To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Canopy closure > 70%, and
- Low perch = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Canopy closure > 70%, and
- Low perch = present.

Treatment Implications

Not available.

European Starling (*Sturnus vulgaris*)

Goal Description

The user wishes to create or enhance habitat for the European starling.

Species Information—Species information includes the following:

Range: Breeding—southern half of Canada south throughout most of United States except in extreme southwestern portions, though now invading northern Sonoran Desert. Winter—throughout United States.

Relative abundance in New England: Abundant.

Habitat: Breeding—farms, cities, orchards, gardens, and parks; prefers rural areas with pastures, cultivated fields and hayfields. Winter—roost in dense vegetation or on buildings in villages and cities; probably absent from high mountains.

Special habitat requirements: Cavities for nesting; minimum dbh of trees suitable for nesting is 25.4 cm.

Nest site: A cavity almost anywhere, including crevices created by highway construction in exposed rock ledges; often in natural or existing excavated cavities in trees, barns and other buildings, drain pipes, and cupolas.

Territory size: Birds defended a 25.4 to 50.8 cm radius around nest holes.

Sample densities: In Scotland, 20 breeding females per km^2 (some in nest boxes) on a farm.

Foraging: Major food—insects, seeds, fruits, and cultivated grains. Substrates—soil surface, sub-surface to depths not exceeding the length of the bill. Techniques—ground gleaning and probing. Preferred feeding habitat—lawns, meadows and grazed fields; starlings prefer to forage in low vegetation; feeds up to three-fourths of a mile from nest site.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, eastern hemlock, northern red oak, white pine / red oak / red maple, or white pine, and
- Size class = regeneration or large sawtimber, and
- Ground layer percent cover > 75%, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration, large sawtimber, or uneven-age, and
- Ground layer percent cover > 75%, and
- Live cavity tree or dead cavity tree = present.

Treatment Implications

Not available.

Evening Grosbeak (*Coccothraustes vespertinus*)

Goal Description

The user wishes to create or enhance habitat for the evening grosbeak.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to British Columbia, south to northern New England, Minnesota, Mexico (mountains), and California. Winter—breeding range south to South Carolina, Texas, and California.

Relative abundance in New England: Common (Maine) to uncommon (Berkshire Hills) in breeding season; irregularly common in winter.

Habitat: Breeding—coniferous forests. Winter—coniferous and deciduous woodlands.

Special habitat requirements: Coniferous forests.

Nest site: Usually in a conifer, occasionally in a deciduous tree.

Foraging: Major foods—buds, fruits, seeds, and insects. Substrates—branches of trees. Techniques—branch gleaning and budding.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age.

OR

- HAM forest type = bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber.

Treatment Implications

Not available.

Fox Sparrow (*Passerella iliaca*)

Goal Description

The user wishes to create or enhance habitat for the fox sparrow.

Species Information—Species information includes the following:

Range: Breeding—northern Quebec, west to Alaska, south to southern Quebec, Colorado and southern California. Winter—coastal Massachusetts south to Florida, Pennsylvania, west to British Columbia, south to New Mexico and the Gulf States.

Relative abundance in New England: Uncommon.

Habitat: Winter—dense woodland thickets, brushy edges where field meets forest.

Foraging: Major foods—insects, weed seeds, and fruits. Substrates—leaf litter. Techniques—scratching and ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%.

Treatment Implications

Not available.

Golden Eagle (*Aquila chrysaetos*)

Goal Description

The user wishes to create or enhance habitat for the golden eagle.

Species Information—Species information includes the following:

Range: Breeding—edge of Arctic tundra across North America, south to the mountains of North Carolina, Mexico, and California; has nested in Vermont, New Hampshire, and Maine. Winter—withdraws from northernmost parts of breeding range.

Relative abundance in New England: Very rare in all seasons.

Habitat: Breeding—cold-temperature conifer forests, rugged mountain ranges near open land for hunting. Winter—timbered portions of New England with open expanses for hunting.

Special habitat requirements: Elevated nest sites, especially cliffs; broad expanses of open land for hunting.

Nest site: Usually on a cliff, crag, or less commonly in a large tree; pairs often attend alternate unoccupied nests in the vicinity of active nest, until the eggs are laid.

Territory size: 51.8 to 155.4 km^2 with an average of about 93.2 km^2.

Home range: Range is 130 to 259 km^2.

Sample densities: In Idaho, 56 breeding pairs per 240 km stretch of Snake River; 1 pair per 8 km of river; 1 pair per 5 km of river; density is probably a function of availability of suitable nest sites, adequate prey, and minimum nesting territory size.

Foraging: Major foods—small to medium mammals (preferred), medium to large birds, reptiles, carrion (when live food is scarce). Substrate—ground. Techniques—soaring, diving, and pouncing. Preferred feeding habitat—open country, burns, marshes, bogs, hillside meadows, bald knobs, and fields.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, or birch, and
- Size class = regeneration, and
- Canopy closure ≤ 30%.

OR

- HAM forest type = northern hardwoods, white pine / red oak / red maple, or white pine, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- Canopy closure ≤ 30%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, eastern hemlock, or northern red oak, and
- Size class = regeneration or large sawtimber, and
- Canopy closure ≤ 30%.

Treatment Implications

Not available.

Golden-crowned Kinglet (*Regulus satrapa*)

Goal Description

The user wishes to create or enhance habitat for the golden-crowned kinglet.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia west to southeastern Alaska, south to Massachusetts, the mountains of North Carolina, New Mexico, and southern California. Winter—southern New England west to Ohio and British Columbia, south to northern Florida and southern California.

Relative abundance in New England: Common to uncommon.

Habitat: Breeding—mainly in dense, northern coniferous forests of spruce but nests in pine, fir, hemlock, and tamarack woods and cedar bogs; evergreen plantations in central and western New York provide suitable habitat. Winter—moist coniferous, mixed, or deciduous forests, thickets and low tangles of weedy growth.

Nest site: Usually woven into twigs of a horizontal limb of a conifer.

Sample densities: In Adirondack coniferous forest, 1 pair per 0.8 ha; 32 pairs per 40 ha in virgin spruce-hemlock bog forest in Maryland.

Foraging: Major foods—insects. Substrates—leaves, branches and twigs, and trunks (bark crevices). Techniques—gleaning, hawking, and hover-gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, white pine/red oak/red maple, or white pine, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Golden-winged Warbler (*Vermivora chrysoptera*)

Goal Description

The user wishes to create or enhance habitat for the golden-winged warbler.

Species Information—Species information includes the following:

Range: Breeding—Wisconsin, southern Michigan, central New York, southern Connecticut, central Massachusetts, southern Vermont, south to northern Illinois, northern Indiana, southern Ohio, western Pennsylvania, northern New Jersey; in mountains in northern Georgia. Winter—from Guatemala south to northern South America.

Relative abundance in New England: Rare (Vermont).

Habitat: Breeding—damp fields heavily vegetated with thick grass, clumps of bushes and briars, deciduous damp woods, especially gray birch stands; sometimes found on higher ground; avoids mountains.

Special habitat requirements: Brushy open areas, especially clearings in deciduous woodlands with saplings, forbs, and grasses.

Nest site: On the ground generally supported by a base of dead leaves and weed stalks.

Territory size: Less than 0.4 ha to almost 0.8 ha per pair (New York); territories usually consisted of overgrown fields with many shrubs and small trees (under 6.0 m), bordered by taller deciduous trees. Burke Lake, Michigan (2.7 ha per pair) habitat—an extensive tamarack swamp surrounded by higher, drier oak-hickory woods. Island Lake, Michigan (1.9 ha per pair) habitat—a low swamp of tamarack, poison sumac, red osier and gray dogwood and poplars.

Sample densities: In Maryland, 17 territorial males per 40 ha in dense second-growth forest.

Foraging: Major foods—small bugs and larvae, cankerworms, and spiders. Substrates—terminal twigs of high branches in tall trees. Techniques—twig hopping and gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer cover > 0%.

Treatment Implications

Not available.

Gray Catbird (*Dumetella carolinensis*)

Goal Description

The user wishes to create or enhance habitat for the gray catbird.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia west to British Columbia, south to Florida and New Mexico. Winter—coastal sections from Long Island (a few) south to Mexico.

Relative abundance in New England: Common in breeding season.

Habitat: Breeding—dense thickets of shrubs, briars, vines along woodland borders, lowland tangles near streams, ponds and swamps, shrubbery around buildings especially in hedgerows and gardens, forest clearings with brushy edges; rare at high elevations. Winter—milder coastal regions where persistent fruits are available throughout the winter.

Special habitat requirements: Low, dense, woody vegetation for nesting, usually with an overtopping deciduous tree layer (3 to 9 m) above.

Nest site: Builds in dense thickets of briars, vines, shrubs or low trees; nests are typically well hidden by foliage; grape vines, hawthorns, and multiflora rose are favored sites.

Home range: In Illinois, 0.06 to 0.1 ha (average 0.1 ha) in swamp-thicket.

Sample densities: In New York, 1 nest per 3.2 ha in mixed shrub-small tree habitat within beech-maple-hemlock community; 15 pairs per km^2 (maximum density) in favorable habitat in North Dakota; 80 territorial males per 40 ha in shrub swamp; 35 territorial males per 40 ha in brushy abandoned farmland in Maryland.

Foraging: Major foods—small fruits and insects. Substrates—fruit-bearing shrubs, leaf litter on ground. Technique—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, or birch, and
- Size class = regeneration, sapling, or pole, and
- Shrub layer percent cover > 20%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%.

OR

- HAM forest type = northern hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration or large sawtimber, and
- Shrub layer percent cover > 20%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%.

OR

- HAM forest type = bottomland hardwoods, and
- Shrub layer percent cover > 20%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%.

Treatment Implications

Not available.

Gray-cheeked Thrush (*Catharus minimus*)

Goal Description

The user wishes to create or enhance habitat for the gray-cheeked thrush.

Species Information—Species information includes the following:

Range: Breeding—northern Newfoundland west to Alaska south to the mountains of northern New England and southeastern New York, and the southern Canadian provinces; locally in Berkshires and Catskills in highest mountains. Winter—South America.

Relative abundance in New England: Uncommon (Maine).

Habitat: Breeding—moist northern coniferous forests, especially in stunted spruce-fir tangles of mountain tops.

Special habitat requirements: Coniferous forests.

Nest site: Usually in bush or the fork of a low conifer limb, occasionally in a birch, sometimes builds on ground under low-hanging limb.

Foraging: Major foods—insects and wild fruits. Substrates—forest floor which is usually carpeted with sphagnum and other mosses. Techniques—Ground gleaning. Preferred feeding habitat—on ground in forest interior.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = balsam fir, spruce-fir, or red spruce, and
- Coniferous shrub layer cover > 0%, and
- Coniferous midstory cover ≥ 25%.

Treatment Implications

Not available.

Great Crested Flycatcher (*Myiarchus crinitus*)

Goal Description

The user wishes to create or enhance habitat for the great crested flycatcher.

Species Information—Species information includes the following:

Range: Breeding—New Brunswick, west to southeastern Manitoba, south to Florida and Texas. Winter—southern Florida and southern Texas to northern South America.

Habitat: Breeding—edges of deciduous or mixed woodlands, swamps, old orchards (with dead limbs or trees), woodland clearings, sometimes along sides of ravines, and deep forests; prefers forests with mature trees but also uses second-growth woodlands.

Special habitat requirements: Cavity for nesting (middle-aged to mature trees), deciduous forest, and edge.

Nest site: In a cavity in a live or dead tree; accepts nest boxes; uses natural cavities or abandoned woodpecker holes.

Territory size: In Illinois, 0.2 to 1.9 ha (average 1.3 ha) for 26 territories; 1.6 to 3.2 ha; 2.9, 2.7, and 2.3 ha in forest-field edge habitat in Kansas.

Sample densities: In Illinois, 50 birds per 40 ha in suburban habitats; 8 pairs per 40 ha in mixed oak forest in Maryland; 7 pairs per 40 ha in dense second-growth oak-maple in Maryland; 4 pairs per 40 ha in hedgerows and active and abandoned farmland in Maryland.

Foraging: Major foods—flying insects, insect larvae, and fruits. Substrates—air, crevices in bark of trees, cracks in fallen logs, and leaf surfaces. Techniques—hawking, gleaning, and hover-gleaning. Preferred feeding habitat—birds spend much time foraging in forest canopy.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-aged, and
- Live cavity tree or dead cavity tree = present, and
- 30 < canopy closure ≤ 70%.

OR

- HAM forest type = bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine / red oak / red maple, or white pine, and
- Size class = small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present, and
- 30 < canopy closure ≤ 70%.

Treatment Implications

Not available.

Great Horned Owl (*Bubo virginianus*)

Goal Description

The user wishes to create or enhance habitat for the great horned owl.

Species Information—Species information includes the following:

Range: Breeding—Northern tree limit in Canada, south to southern America. Winter—same as breeding range.

Relative abundance in New England: Locally common to uncommon.

Habitat: Breeding—deep woods remote from populated areas, large farm woodlots, often in deep swamps near a large stream or woodland pond; mixed countryside of forest and fields; extensive wooded areas with mature trees are preferred over small woodlots with second-growth trees. Winter—same as breeding habitat.

Special habitat requirements: Large abandoned birds' nests or large cavities for nesting.

Nest site: Commonly uses the old nest of a large bird such as heron, crow, or hawk; also nests in large natural cavities in trees and on ledges.

Sample densities: In Michigan, 1 pair per 13.7 km^2 in Michigan; 1 pair per 7.8 km^2 in Wyoming; 1 pair per 2.8 km^2 in Kansas; optimum habitat probably supports from 0.4 to 1 pair per km^2; 1 pair per 11.4 km^2 in deciduous woodland in New York.

Foraging: Major foods—lagomorphs and rodents are staple foods; other prey includes birds, small carnivorous mammals, and reptiles. Substrate—forest floor. Techniques—silent approach to prey via silent, direct, rapid flight, swooping, and pouncing. Preferred feeding habitat—sometimes leaves woodlands to hunt over meadows and salt marshes.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Canopy closure > 70%.

Treatment Implications

Not available.

Hairy Woodpecker (*Picoides villosus*)

Goal Description

The user wishes to create or enhance habitat for the hairy woodpecker.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to Alaska, south to Central America. Winter—same as breeding range.

Relative abundance New England: Common.

Habitat: Breeding—open coniferous, deciduous and mixed woodlands with mature living and dead trees, and wooded swamps; prefers bottomland areas with large trees. Winter—a shift to more residential habitat occurred in southern Illinois; birds may move to more open country.

Special habitat requirements: Trees with a dbh of 25.4 cm or more are most suitable for nesting.

Nest sites: Cavity in living (often) or dead tree, in trunk or underside of large limb; favors trees with decayed interior; nests found in trees with dbh range of 30.5 to 45.7 cm; nests were in both dead trees and dead parts of living trees in sparsely to fully stocked stands.

Territory size: In Illinois, 2.6 ha (one territory) in mature upland forest; 0.6 to 1.5 ha (average 1.1 ha) in mature bottomland in Illinois.

Home range: In Ontario, 2.4 to 3.2 ha (estimated minimum sizes of 2 ranges) in second growth forest.

Sample densities: In Illinois, 17 to 24 birds per 40 ha in mature bottomland forest; 4 birds per 40 ha in upland oak-hickory forest in Illinois.

Foraging: Major foods—adults and larvae of beetles, ants and caterpillars are staples, but also eats fruits, nuts, and corn. Substrates—bark crevices of living and dead trees, trunks, branches, rotting stumps, and under loose bark. Techniques—gleaning, drilling, and scaling.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Size class = small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Live cavity tree or dead cavity tree = present.

Treatment Implications

Not available.

Hermit Thrush (*Catharus guttatus*)

Goal Description

The user wishes to create or enhance habitat for the hermit thrush.

Species Information—Species information includes the following:

Range: Breeding—Labrador west to Alaska, south to southern New York, the mountains of West Virginia and Maryland, central Minnesota and through the Rockies to New Mexico. Winter—southern Massachusetts, eastern Pennsylvania and southern Ohio, south to Florida and Central America.

Relative abundance in New England: Common (Maine) to uncommon (Massachusetts).

Habitat: Breeding—lowlands in wooded swamps and damp forests and uplands in dry, brushy clearings in coniferous or mixed forests; also frequents woodland edges and brushy pastures and cool north-facing slopes. Winter—borders of wooded swamps where birds find shelter in thick hummocks; areas with persistent fruits or shrubs or vines or well stocked feeding stations.

Special habitat requirements: Coniferous or mixed woodlands with dense young undergrowth. In winter, birds require abundant native fruits.

Nest site: Usually on ground on a hummock, or in dense ferns or other cover, or under a low-hanging conifer limb; occasionally to 1.2 m in a sapling.

Sample densities: 40 to 93 birds per 40 ha in second-growth or cut-over woods; 20 birds per 40 ha in bottomland forest in Illinois; 6 to 10 birds per 40 ha in upland forest in Illinois.

Foraging: Major foods—insects and fruits. Substrate—leaf litter. Technique—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, white pine / red oak / red maple, or white pine, and
- Deciduous shrub layer cover > 0%, and
- Canopy closure > 30%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Deciduous shrub layer cover > 0%, and
- Canopy closure > 30%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = balsam fir, spruce-fir, or red spruce, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Deciduous shrub layer cover > 0%, and
- Canopy closure > 30%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = eastern hemlock, or northern red oak, and
- Size class = small sawtimber, or large sawtimber, and
- Deciduous shrub layer cover > 0%, and
- Canopy closure > 30%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Treatments may include the following:

- Maintaining a variety of coniferous and mixed coniferous and deciduous forests;
- Maintaining dense understories.

Hooded Warbler (*Wilsonia citrina*)

Goal Description

The user wishes to create or enhance habitat for the hooded warbler.

Species Information—Species information includes the following:

Range: Breeding—Connecticut, central New York, southern Michigan, northern Iowa, and southeastern Nebraska, south to northern Florida and the Gulf Coast west to Louisiana. Winter—Mexico to Panama.

Relative abundance in New England: Locally common to uncommon.

Habitat: Breeding—most often in brushy, swampy lowlands, less frequently at edges and interiors of well-watered mature deciduous woodlands with dense undergrowth or on rich, moist hillsides in thickets of laurel; favors lowlands.

Special habitat requirements: Low, dense, woody vegetation (deciduous).

Nest site: Above ground in a bush, sapling, or herbaceous vegetation.

Sample densities: In Maryland, 32 territorial males per 40 ha in second-growth river swamp; 32 territorial males per 40 ha in young second growth; 17 territorial males per 40 ha in open slash area; 8 territorial males per 40 ha in upland oak forest.

Foraging: Major foods—grasshoppers, locusts, caterpillars, plant lice, wasps, ants, moths, beetles, flies, bugs, and caddis flies. Substrate—air. Techniques—hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, bottomland hardwoods, or northern red oak, and
- Size class = regeneration or large sawtimber, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%.

OR

- HAM forest type = white pine/red oak/red maple, and
- Size class = large sawtimber, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer or ericaceous shrub layer cover> 0%.

Treatment Implications

Not available.

House Finch (*Carpodacus mexicanus*)

Goal Description

The user wishes to create or enhance habitat for the house finch.

Species Information—Species information includes the following:

Range: Breeding—introduced to New York City and spread to central New England, Pennsylvania, New Jersey, Maryland, and Delaware; the western (native) range extends from British Columbia to southern Mexico. Winter—same as breeding range.

Relative abundance in New England: Common (spreading rapidly northward throughout New England).

Habitat: Breeding—rural, suburban and urban yards, city parks, farms, and open woods. Winter—same as breeding habitat.

Special habitat requirements: Birds may require open ground with low seed-producing plants and fruits and berries during part of year.

Nest site: Uses a variety of sites including buildings, ledges, tree cavities, bird houses, vines (especially ivy) on buildings; in the eastern United States, birds seem to be associated with conifers, especially cultivated varieties such as arborvitae and hedges.

Foraging: Major foods—weed seeds, wild and cultivated fruit, and insects. Substrates—weeds and grasses. Technique—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type is white pine/red oak/red maple

Treatment Implications

Not available.

House Wren (*Troglodytes aedon*)

Goal Description

The user wishes to create or enhance habitat for the house wren.

Species Information—Species information includes the following:

Range: Breeding—New Brunswick west to British Columbia, south to South Carolina, Missouri, and Texas. Winter—southern Maryland west to California, south to southern Mexico; rarely farther north.

Relative abundance in New England: Common (southern New England) to uncommon (Maine).

Habitat: Breeding—near human dwellings with sufficient woody vegetation and cavities for nesting, edges of woodlands, farmland, open forests and clearings, suburban gardens, orchards, and swampy woodlands; very adaptable in nesting habits; avoids deep forest interiors and high elevations. Winter—thickets and brush piles.

Special habitat requirements: Cavity for nesting in tree with minimal dbh of 25.4 cm.

Nest site: Nests in cavity in a variety of sites such as trees, fence posts, tin cans, eaves of buildings, and nest boxes; cavity may be natural, excavated by a woodpecker, or manmade.

Territory size: In Ohio, 178 territories ranged from 0.1 to 1.1 ha in forest edge and shrubby pasture habitat.

Sample densities: In North Dakota, 15 pairs per km^2 (maximum density) in favorable habitat; 100 territorial males per 40 ha in farmyard and orchard in Maryland; 50 territorial males per 40 ha in damp deciduous scrub with standing snags in Maryland; 14 territorial males per 40 ha in unsprayed orchard in Maryland.

Foraging: Major foods—small insects, beetles, caterpillars, and bugs. Substrates—low woody vegetation. Techniques—ground and shrub stem gleaning and hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

-
- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Shrub layer percent cover > 50%, and
- Live cavity tree or dead cavity tree = present.

Treatment Implications

Not available.

Indigo Bunting (*Passerina cyanea*)

Goal Description

The user wishes to create or enhance habitat for the indigo bunting.

Species Information—Species information includes the following:

Range: Breeding—New Brunswick, west to North Dakota, south to Georgia and Texas. Winter—Mexico and Central America (casually north along coast to Massachusetts).

Relative abundance in New England: Common.

Habitat: Breeding—edges of woods, old burns, open brushy fields, roadside thickets, and brushy ravines; tends to be numerous along creeks and rivers; avoids deep woods; forest clearings created by logging and burning have been used extensively by the birds in the northeast and have led to range expansion.

Special habitat requirements: Brushy vegetation and elevated perches.

Nest site: In dense cover, usually in weeds or in fork of shrub, low tree, or in brambles.

Territory size: In Kansas, 1.1 ha in sapling, shrub, and vine habitat; average 0.1 ha in swamp-thicket in Illinois.

Sample densities: In thickets, 5 nests per 2.9 ha; in forest edge, 9 to 18 pairs per 1.6 km; in apple orchard, 13 pairs per 10.1 ha.

Foraging: Major foods—insects and weed seeds. Substrates—branches, leaf surfaces, and bare soil. Techniques—ground and twig gleaning. Preferred feeding habitat—cornfields in late summer.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, sapling, or pole, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Low perch = present.

Treatment Implications

Not available.

Kentucky Warbler (*Oporornis formosus*)

Goal Description

The user wishes to create or enhance habitat for the Kentucky warbler.

Species Information—Species information includes the following:

Range: Breeds from southeastern Nebraska, southwestern Wisconsin, southern Michigan, central Ohio, southern Pennsylvania, and southeastern New York south to eastern Texas, the Gulf Coast, central Georgia, and South Carolina; casual in southwestern states. Winter—from Mexico south to northern South America.

Relative abundance in New England: Does not occur in New England.

Habitat: Inhabits shrubby woodland borders and the understory of damp or shady deciduous woods, favoring moist ravines and bottomlands; often found near water and at low elevations.

Special habitat requirements: Unreported.

Nest site: Generally builds nest on the ground among plants at the base of shrubs and trees, or under branches of fallen limbs; occasionally places nest near the ground in shrubs; commonly victimized by brown-headed cowbirds.

Territory Size: Unreported.

Sample Densities: Unreported.

Foraging: Gleans most food from leaves on the ground, but occasionally catches insects from low leaves and branches; mostly eats spiders and insects.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type is white pine/red oak/red maple; and
- Size class is small sawtimber or large sawtimber; and
- Shrub layer percent cover > 20; and
- Deciduous shrub layer > 20;
- Deciduous midstory > 25; and
- Canopy closure > 30 and ≤ 70.

OR

- HAM forest type is aspen or birch or northern hardwoods or bottomland hardwoods or northern red oak; and
- Shrub layer percent cover > 20; and
- Deciduous shrub layer > 20;
- Deciduous midstory > 25; and
- Canopy closure > 30 and ≤ 70.

Treatment Implications

Not available.

Least Flycatcher (*Empidonax minimus*)

Goal Description

The user wishes to create or enhance habitat for the least flycatcher.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia to Mackenzie district, Northwest Territories, south to Long Island and central New Jersey and the mountains of Georgia, west to Wyoming and British Columbia. Winter—Mexico and Central America.

Relative abundance in New England: Common.

Habitat: Breeding—deciduous forest edges, burns and clearings, open shrublands, orchards, well-planted residential areas, edges of country roads, overgrown pastures, and open deciduous woodlands.

Special habitat requirements: Open deciduous forest, edge (shade for nest and open space for feeding), and moderately vegetated woodlands (intermediate openness in understory).

Nest site: In crotch or on limb of deciduous or coniferous tree; known to nest in apple, oak, pine, willow, sugar maple, and others.

Territory size: In Virginia, 0.1 to 0.2 ha in oak-chestnut woodland; in Michigan, 0.01 to 0.2 ha (average 0.07 ha) for 33 territories; usually less than 0.4 ha.

Sample densities: In Illinois, 2 nests per 11.2 ha of residential woodland; in Virginia, 9 nests per 7.7 ha in an oak-chestnut woodland; in Michigan, 2.7 pairs per 0.4 ha in aspen-birch-maple habitat.

Foraging: Major foods—flying insects. Substrate—air. Techniques—hawking, flight-gleaning, and gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, balsam fir, spruce-fir, red spruce, northern red oak, or white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- 30 < ground layer percent cover ≤ 75%, and
- Canopy closure > 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- 30 < ground layer percent cover ≤ 75%, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Lincoln's Sparrow (*Melospiza lincolnii*)

Goal Description

The user wishes to create or enhance habitat for the Lincoln's sparrow.

Species Information—Species information includes the following:

Range: Breeding—Quebec, west to Alaska, south to northern New England, northern Minnesota, New Mexico and southern California. Winter—southwestern United States, south to Central America.

Relative abundance in New England: Uncommon.

Habitat: Breeding—Thickets of alder and willow along bogs, lakes, and streams; natural brushy openings and clearings created by fire or cutting, dry rocky hillsides with low shrub growth.

Special habitat requirements: Needs low brushy growth 1.2 to 2.4 m high with openings of grasses or sedges.

Nest site: Often on tussock of grass or sedge or in mosses and lichens; usually well hidden by surrounding vegetation.

Territory size: Size is about 0.4 ha in forest edge habitat in Ontario.

Foraging: Major foods—insects (more than 60% in summer); weed seeds and grain. Substrate—leaf litter. Technique—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, balsam fir, red spruce, eastern hemlock, or white pine, and
- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Shrub layer percent cover > 50%.

Treatment Implications

Not available.

Louisiana Waterthrush (*Seiurus motacilla*)

Goal Description

The user wishes to create or enhance habitat for the Louisiana waterthrush.

Species Information—Species information includes the following:

Range: Breeding—from central Nebraska, east to southern Ontario, Vermont, and New Hampshire, south to eastern Oklahoma, eastern Texas, Louisiana, across to northeastern North Carolina. Winter—from southern Sonora, Mexico, Cuba, Bahamas, and Bermuda, south to Panama, Trinidad, Colombia, and Venezuela.

Relative abundance in New England: Uncommon.

Habitat: Breeding—Bottomland forests where moss-covered logs and rank undergrowth give an almost tropical character to the surrounding; wooded valleys of rocky brooks or small streams; sometimes in woods; favors wooded streams and brooks with swiftly flowing water; avoids high elevations.

Special habitat requirements: Woodlands with flowing water, especially streams and brooks.

Nest site: In cavity in bank of stream or among upturned roots of a fallen tree.

Sample densities: In Maryland, 16 territorial males per 40 ha in second-growth river swamp; 4 territorial males per 40 ha in well-drained floodplain forest.

Foraging: Major foods—dragonfly and cranefly larvae, beetles, bugs, ants, caterpillars, scale insects, spiders, and mollusks. Substrates—sandy margins of streams. Technique—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = bottomland hardwoods, and
- Streams = present, and
- Ground layer percent cover ≤ 30%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Not available.

Magnolia Warbler (*Dendroica magnolia*)

Goal Description

The user wishes to create or enhance habitat for the magnolia warbler.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland west across Canada to central Northwestern Territory, south to central British Columbia, Alberta, and east to Wisconsin, southern Ontario and western Massachusetts; southward in the mountains to southwestern North Carolina. Winter—Mexico south to Panama.

Relative abundance in New England: Common (mountains).

Habitat: Breeding—usually in small clumps of spruce or hemlocks, or in small coniferous saplings in old fields; associated with woodland edges and clearings.

Special habitat requirements: Stands of young conifers.

Nest site: Commonly in young conifers, rarely in hardwoods, on a horizontal branch.

Territory size: Size includes 20 males who had territories which averaged 0.7 ha in size; habitat includes hemlock and beech in New York. Differences in breeding territory size occurred in different forest types—aspen (average) is 0.7 ha; conifer-birch (average) is 0.9 ha; mixed (average) is 1.0 ha; and maple (average) is 1.3 ha.

Sample densities: At Loud's Island, Maine, 22 pairs per 40 ha (forest is 83% red spruce, 14% white spruce); at Marsh Island, Maine, 15 pairs per 40 ha (100% white spruce); at Harbor Island, Maine, 42 pairs per 40 ha (100% white spruce); in Maryland, 80 males per 40 ha in virgin hemlock forest; in Maryland, 63 males per 40 ha in open hemlock-spruce bog and 33 males per 40 ha in scrub spruce bog.

Foraging: Major foods—weevils, leaf-beetles, leaf hoppers, plant lice, scale insects, ants, caterpillars, and moths. Substrates—branches of small trees or shrubs. Techniques—twig and leaf gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = balsam fir, or spruce-fir, and
- Size class = regeneration, sapling, pole, or small sawtimber, and
- Coniferous shrub layer cover > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = red spruce, and
- Size class = regeneration, sapling, or pole, and
- Coniferous shrub layer cover > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = eastern hemlock, and
- Coniferous shrub layer cover > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Mourning Dove (*Zenaida macroura*)

Goal Description

The user wishes to create or enhance habitat for the mourning dove.

Species Information—Species information includes the following:

Range: Breeding—central Maine, New Hampshire, Vermont and New York, west to British Columbia, south to the Bahamas and Mexico. Winter—southern Maine, New Hampshire and Vermont, west to Oregon, south to Central America.

Relative abundance in New England: Common.

Habitat: Breeding—open mixed woodlands and woodland edges, evergreen plantations, orchards and farmlands, suburbs, and cities; avoids dense forests and high elevations (mountains); birds nest most frequently in agricultural and residential areas. Winter—similar to breeding habitat.

Special habitat requirements: Open land with bare ground that produces adequate food (seeds).

Nest site: Often in a coniferous tree; also in tangles of shrubs or vines; occasionally uses old nest of other bird to support its twig platform; nest is typically placed on a horizontal limb; solitary or loosely colonial; coniferous vegetation 0 to 10.7 m high important to mourning dove occurrence.

Sample densities: Relative densities of breeding mourning doves based on the mean number heard per 32 km survey route: 0 to 9.9 birds (Maine, New Hampshire, Vermont, western Pennsylvania, eastern Ohio, West Virginia); 10.0 to 29.9 birds (Massachusetts, Rhode Island, Connecticut, New Jersey, eastern Pennsylvania, Maryland); 30.0 to 59.9 birds (western Ohio); 29 pairs per km^2 in favorable habitat in North Dakota.

Foraging: Major foods—weed seeds and waste grain of agriculture, occasionally takes small snails. Substrates—open and bare ground; short grasses. Techniques—walking and ground gleaning. Preferred feeding habitat—cultivated fields.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = red spruce, and
- Size class = regeneration, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Not available.

Mourning Warbler (*Oporornis philadelphia*)

Goal Description

The user wishes to create or enhance habitat for the mourning warbler.

Species Information—Species information includes the following:

Range: Breeding—southeastern Canada south to the Berkshires, Catskills, Poconos, and higher elevations of West Virginia and Virginia, northern Minnesota, Michigan. Winter—Central America and northern South America.

Relative abundance in New England: Locally common to uncommon breeder.

Habitat: Breeding—Dense underbrush on the margin of a lowland swamp or bog; bushy hillsides, forest clearings grown up to brambles, shrubs and saplings.

Special habitat requirements: Extensive stands of dense saplings and shrubs.

Nest site: On ground in tangles of briars, weeds, or grasses.

Territory size: Size is10 territories that range from 0.6 to 1.0 ha, average is 0.8 ha in Minnesota.

Sample densities: In Maryland, 10 territorial males per 40 ha in dense second growth.

Foraging: Major foods—beetles, lepidopterans, and spiders. Substrates—thick underbrush. Techniques—ground, shrub, and stem gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, or northern red oak, and
- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer > 0%.

Treatment Implications

Not available.

Nashville Warbler (*Vermivora ruficapilla*)

Goal Description

The user wishes to create or enhance habitat for the Nashville warbler.

Species Information—Species information includes the following:

Range: Breeding—southern Canada and northern United States. In the northeast, the range extends south to Maryland (mountains) and rarely to Connecticut and Long Island. Winter—Central America.

Relative abundance in New England: Common.

Habitat: Breeding—moist open deciduous woods, overgrown pastures and fields, swampy areas, edges of woodlands, clearings with much young second-growth vegetation, especially young trees 10 to 12 ft tall; birds reportedly breed in both dry and moist situations, favoring spruce-sphagnum bogs in central New York.

Special habitat requirements: Scattered trees interspersed with brush.

Nest site: Depression in moss or beneath canopy of dried, dead bracken fern; well hidden.

Territory size: Size is about 0.2 ha per pair in Ontario.

Sample densities: In Maryland, 39 territorial males per 40 ha in scrub spruce bog; 21 territorial males per 40 ha in open hemlock-spruce bog in Maryland.

Foraging: Major foods—adults, larvae, and eggs of various insects including small grasshoppers, plant lice, caterpillars, and beetles. Substrates—trunks, branches, and leaves of trees. Techniques—hopping from bottom to the top of a tree hawking insects encountered.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, or birch, and
- Size class = sapling or pole, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer, coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = balsam fir, and
- Size class = small sawtimber, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer, coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = spruce-fir, red spruce, or white pine, and
- Size class = sapling, pole, or small sawtimber, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer, coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = eastern hemlock, northern red oak, or white pine / red oak / red maple, and
- Size class = small sawtimber, or large sawtimber, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer, coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%.

OR

- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer, coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Not available.

Northern Cardinal (*Cardinalis cardinalis*)

Goal Description

The user wishes to create or enhance habitat for the northern cardinal.

Species Information—Species information includes the following:

Range: Breeding—central New England, west to South Dakota, south to Florida and Texas. Winter—same as above.

Relative abundance in New England: Common (Connecticut, Rhode Island, Massachusetts) to uncommon (Maine).

Habitat: Breeding—forest edges, open woodlands (less common in deep forest unless thickets are present), groves, parks, suburban gardens, open swamps, residential areas, and parks. Winter—same; easily attracted to feeding stations with sunflower seeds.

Special habitat requirements: Heavy underbrush such as *Lonicera* spp. or *Cornus* spp.

Nest site: In dense shrubs, small deciduous or coniferous trees, tangles of vines, thickets, and briars.

Home range: In Tennessee, 0.51 to 2.32 ha (average 1.18 ha), but 10.97 to 23.24 ha (average 18.81 ha) in Ontario; 0.1 to 0.2 ha (average 0.1 ha) in swamp thicket in Illinois; cardinals range no further than a few miles from their territory during their lifetime.

Sample densities: In Tennessee, 30 males per 40 ha in oak-hickory forests with clearings and hedgerows; 0.48 males per 40 ha in beech-maple woodlots in Ontario; 23 territorial males per 40 ha in semi-open floodplain forest; 5 territorial males per 40 ha in field and edge.

Foraging: Major foods—seeds and fruits, waste grains, and insects. Substrate—ground. Technique—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, or northern red oak, and
- Size class = regeneration, and
- Shrub layer percent cover > 20%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%, and
- Low perch = present.

OR

- HAM forest type = bottomland hardwoods, or white pine / red oak / red maple, and
- Shrub layer percent cover > 20%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%, and
- Low perch = present.

OR

- HAM forest type = white pine, and
- Size class = regeneration or large sawtimber, and
- Shrub layer percent cover > 20%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%, and
- Low perch = present.

Treatment Implications

Treatments may include the following:

- Maintaining brushy areas with a high number of woody plants per acre; and
- Maintaining trees and shrubs that produce fruit and berries.

Northern Flicker (*Colaptes auratus*)

Goal Description

The user wishes to create or enhance habitat for the northern flicker.

Species Information—Species information includes the following:

Range: Breeding—Labrador west to Alaska (northern tree limit), south to Florida, the Gulf Coast, and Central America. Winter—central New England, west to South Dakota, south to the Gulf Coast.

Relative abundance in New England: Common.

Habitat: Breeding—open deciduous, coniferous, or mixed woods, woodland edges (preferred), suburbs, farm woodlots, clearcuts in dense forests, fields, and meadows. Winter—occasionally seeks protection from cold in coniferous woods or swamps.

Special habitat requirements: Medium to large dead or dying trees for nesting; open areas for foraging; trees 30.5 cm dbh or more are most suitable for nesting.

Nest site: Cavity often near top of medium to large tree that is usually dead or dying; flickers accept bird houses with proper dimensions and often use old vacant woodpecker holes; nests in forests are usually located in snags near recent clearcuts; forest edges or groves bordering fields are preferred nest sites.

Territory size: In Illinois, 0.6 ha; territorial defense is limited to nest site during the incubation period; during this period, other flickers may occupy original territory; 3 pairs were observed on less than 0.4 ha.

Sample densities: Average of 33.3 birds per 40 ha in second growth hardwoods in Illinois; 13 birds per 40 ha in oak-hickory type in Illinois; 19 pairs per 40 ha in white pine woodland on Nantucket Island.

Foraging: Major foods—ants (staple) and a variety of other insects, especially ground beetles, crickets, and grasshoppers; also commonly takes wild fruits. Substrates—(surface and depths not exceeding the length of the bird's bill), leaf litter, short grasses, bark, and under surface of bark. Techniques—probing and gleaning. Preferred feeding habitat—grassy areas such as lawns, pastures, openings in woods, and cornfields (especially in winter).

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, small sawtimber, or large sawtimber, and
- Dead cavity tree = present, and
- Canopy closure ≤ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age,and
- Dead cavity tree = present, and
- Canopy closure ≤ 30%.

Treatment Implications

Not available.

Northern Goshawk (*Accipiter gentilis*)

Goal Description

The user wishes to create or enhance habitat for the northern goshawk.

Species Information—Species information includes the following:

Range: Breeding—Canada south to New York, northwestern Connecticut and Pennsylvania and west to Lake Erie. Winter—Southern Canada, south to Virginia and Illinois.

Relative abundance in New England: Uncommon to rare.

Habitat: Breeding—interiors of remote and heavily forested areas, coniferous and mixed forests. Winter—same as breeding habitat.

Special habitat requirements: Extensive mixed woodlands with large trees for nesting.

Nest site: Prefers to nest in a hardwood tree in mixed woodlands; nest may be placed in crotch close to trunk or out on a limb; often builds in beech, birch, poplar, or occasionally pine or hemlock; builds on top of old nest (own or other hawk's) or makes new nest.

Home range: 2.1 km^2 (observed area) in Moose, Wyoming in 1947.

Foraging: Major foods—small to medium birds (staple); mammals, especially rodents and lagomorphs. Substrates—ground, trees and shrubs, and air. Techniques—hawking, diving to ground and pouncing. Preferred feeding habitat—clearings and brushy openings.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, birch, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Canopy closure > 30%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- Canopy closure > 30%.

Treatment Implications

Not available.

Northern Mockingbird (*Mimus polyglottos*)

Goal Description

The user wishes to create or enhance habitat for the northern mockingbird.

Species Information—Species information includes the following:

Range: Breeding—southern Maine west through Ohio to central California, south to the Gulf Coast and southern Mexico. Spreading north. Winter—southern New England, south and west.

Habitat: Breeding—woodland edges, pastures with scattered fruit-bearing shrubs, small trees or groves of large trees, and often in cities. Winter—similar to breeding habitat; among thickets that bear persistent fruits, especially multiflora rose.

Special habitat requirements: Low, dense woody vegetation, elevated perches, and a variety of edible fruits.

Nest site: Usually in a thicket of shrubs or vines or in a dense tree (often an evergreen); prefers sites near houses, especially porch vines, garden, lawn and foundation plantings; prefers to nest in multiflora rose.

Territory size: Territories of five pairs of mockingbirds ranged from 2,475.5 to 5,573.3 m^2. Winter—four females defended areas that ranged from 348.3 to 1857.8 m^2.

Home range: Range is 2 pairs in Michigan occupied home ranges of 18.2 ha compared with an average of 1.0 ha in Tennessee.

Sample densities: In Maryland, 15 territorial males per 40 ha in suburban-residential habitat; 2 territorial males per 40 ha in mixed agricultural habitats.

Foraging: Major foods—wild or cultivated fruits, seeds, and insects. Substrates—ground litter and grasses, shrubs, and trees. Techniques—ground and shrub gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, or white pine/red oak/red maple, and
- Size class = regeneration, and
- Deciduous midstory cover > 25%, and
- Soft mast = present, and
- Low perch = present.

Treatment Implications

Not available.

Northern Oriole (*Icterus galbula*)

Goal Description

The user wishes to create or enhance habitat for the northern oriole.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to British Columbia, south to Georgia, Mexico and southern California. Winter—Mexico to northern South America.

Relative abundance in New England: Common.

Habitat: Breeding—suburban shade trees of lawns and roadsides, groves, orchards, parks, deciduous woodland edges, and along streams and lakes. Winter—locally at feeding stations where fruits and suet are provided.

Special habitat requirements: Tall deciduous trees, prefers elms.

Nest site: Usually high in a deciduous tree, often elm maple, willow, or apple; nest is deeply pendant and is usually attached by its rim to tip of drooping branch; nests in maples, shallow basket placed toward top-center of crown.

Sample densities: In North Dakota, 8 pairs per km^2 in favorable habitat in North Dakota; 10 territorial males per 40 ha in shrubby field with stream-bordered trees in Maryland.

Foraging: Major foods—insects and fruit. Substrates—leaf and twig surfaces. Techniques—foliage and twig gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, bottomland hardwoods, northern red oak, or white pine / red oak / red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Canopy closure ≤ 15%.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Canopy closure ≤ 15%.

Treatment Implications

Treatments may include the following:

- Maintaining large deciduous trees with full crowns at a wide spacing; and
- Maintaining less than 15% canopy closure.

Northern Parula (*Parula americana*)

Goal Description

The user wishes to create or enhance habitat for the northern parula.

Species Information—Species information includes the following:

Range: Breeding—southern Canada to the Gulf States. Winter—central America and the West Indies.

Relative abundance in New England: Common (Maine).

Habitat: Breeding—wooded bogs, swamps, prefers conifers in areas where bearded lichen (Usnea) grows.

Special habitat requirements: Prefers to nest in bearded lichen or use the lichen as nesting material.

Nest site: Usually hanging near the distal end of a limb that is covered with Usnea.

Sample densities: In Maryland, 47 territorial males per 40 ha in well-drained floodplain forest; 29 territorial males per 40 ha in poorly drained floodplain forest; 19 territorial males per 40 ha in second-growth river swamp; 12 territorial males per 40 ha in pine-oak forest.

Foraging: Major foods—beetles, plant lice, inchworms, small hairy caterpillars, and spiders. Substrates—branches, twigs, and leaves of trees. Techniques—foliage and twig gleaning, often hangs upside down, chickadee fashion.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = bottomland hardwoods, or northern red oak, and

- Size class = small sawtimber, or large sawtimber, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, or eastern hemlock, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Northern Saw-whet Owl (*Aegolius acadicus*)

Goal Description

The user wishes to create or enhance habitat for the northern saw-whet owl.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to southeastern Alaska, south to central Ohio and southern New England; breeds in the mountains from Maryland to Missouri. Winter—regularly south to Virginia and casually to southern California.

Relative abundance in New England: Uncommon.

Habitat: Breeding—uses a variety of habitats, including woodlots, roadside shade trees, coniferous and deciduous forest; swampy areas in deep coniferous forest; mature mixed forests with scattered dead trees are preferred nesting habitats. Winter—when deep snow makes food unavailable, birds may move s. in search of prey; birds roost in conifers at edge or interior of extensive woodlands; also in coniferous thickets in park and isolated pines.

Special habitat requirements: Cavity in tree with a minimum dbh of 30.5 cm.

Nest site: Usually in cavity of dead tree; prefers old deserted woodpecker holes, especially those of flickers; birds accept nest boxes with a layer of straw or sawdust inside.

Home range: Approximately 141.7 ha in Minnesota.

Sample densities: 1 bird per 4.8 km^2 in spruce-fir in mountains of North Carolina; maximum 1 pair per 40 ha.

Foraging: Major foods—mainly small mammals, especially mice, young squirrels, shrews, and chipmunks; also takes insects and occasionally small birds. Substrate—forest floor. Techniques—swooping and pouncing.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Dead cavity tree = present
- 15 < canopy closure ≤ 30%, OR
- Canopy closure > 70%.

Treatment Implications

Not available.

Northern Shrike (*Lanius excubitor*)

Goal Description

The user wishes to create or enhance habitat for the northern shrike.

Species Information—Species information includes the following:

Range: Breeding—Northern North America, south to southern Canada. Winter—same as above but occasionally wanders south to Virginia, New Mexico and northern California.

Relative abundance in New England: Rare (winter).

Habitat: Winter—semi-open country with short grasses and scattered trees or shrubs for perches; fences and utility wires also used.

Special habitat requirements: Elevated perches and short vegetation.

Foraging: Major foods—rodents, especially mice, and small birds. Substrates—meadow grasses and air. Techniques—hawking, diving, and pouncing from a perch and hovering. Preferred feeding habitat—open fields with scattered perches.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, or New England lowlands, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Low perch = present.

OR

- Size class = regeneration, sapling, pole, or small sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, or New England lowlands, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Low perch = present.

Treatment Implications

Not available.

Northern Waterthrush (*Seiurus noveboracensis*)

Goal Description

The user wishes to create or enhance habitat for the northern waterthrush.

Species Information—Species information includes the following:

Range: Breeding—southern Quebec, Labrador, and Newfoundland, south to southeastern New York, West Virginia, and Pennsylvania (in Appalachians), southern New England. Winter—mainly from Mexico and the West Indies, south to northern South America.

Relative abundance in New England: Uncommon to common (widespread).

Habitat: Breeding—favors wooded swamps and bogs, and less frequently occurs along woodland brooks or streams and swampy wooded shores of ponds or lakes; commonly breeds at moderately high elevations.

Special habitat requirements: Cool, shady, and wet ground with open pools of shallow water.

Nest site: In cavity on the ground, among roots of fallen trees, at base of moss-covered stump, under mossy logo, or inside of mossy brook bank.

Sample densities: In Maryland, 84 territorial males per 40 ha in open hemlock-spruce bog; 33 territorial males per 40 ha in scrub spruce bog.

Foraging: Major foods—aquatic insects, beetle larvae, moths, mosquitoes, and ants; also takes small crustaceans, mollusks, and worms. Substrates—crevices in rocks. Technique—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, or white pine, and
- Permanent ponds or streams = present, and
- Ground layer percent cover ≤ 30%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Not available.

Olive-sided Flycatcher (*Contopus borealis*)

Goal Description

The user wishes to create or enhance habitat for the olive-sided flycatcher.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to Alaska, south in mountains to Pennsylvania, Wisconsin, Arizona, and southern California. Winter—South America.

Relative abundance in New England: Uncommon to rare.

Habitat: Breeding—coniferous (spruce) forests near edges and clearings, often along wooded streams and borders of northern bogs and muskegs, and burned-over areas with a few dead trees for perches; prefers to be near water.

Nest site: Usually well hidden on a horizontal branch high in a conifer, usually far out from the trunk.

Territory size: Breeding birds require an area of several acres.

Foraging: Major foods—insects, especially hymenopterans. Substrates—air and surfaces of leaves. Techniques—hawking and flight-gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, or bottomland hardwoods, and
- Size class = regeneration, and
- Ericaceous shrub layer cover > 0%, and
- 15 < canopy closure ≤ 30%, and
- High perch = present, and
- Low perch = present.

OR

- HAM forest type = balsam fir, spruce-fir, eastern hemlock, or white pine, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- Ericaceous shrub layer cover > 0%, and
- 15 < canopy closure ≤ 30%, and
- High perch = present, and
- Low perch = present.

OR

- HAM forest type = red spruce, and
- Ericaceous shrub layer cover > 0%, and
- 15 < canopy closure ≤ 30%, and
- High perch = present, and
- Low perch = present.

Treatment Implications

Not available.

Orchard Oriole (*Icterus spurius*)

Goal Description

The user wishes to create or enhance habitat for the orchard oriole.

Species Information—Species information includes the following:

Range: Breeding—eastern Massachusetts, west to North Dakota, south to the Gulf States. Winter—Mexico and northern South America.

Relative abundance in New England: Uncommon to rare.

Habitat: Breeding—orchards, woodland margins and open woodlands (avoids dense forest), and shade trees along country roads and in suburbs; prefers open and cultivated lands near human dwellings; favors low elevations.

Nest site: Nest is suspended between two horizontally forked branches of a tree or shrub and is well concealed by dense foliage.

Sample densities: In Maryland, 29 territorial males per 40 ha in farmyards; 15 territorial males per 40 ha in suburban residential area; 10 territorial males per 40 ha in shrubby field with stream-bordered trees.

Foraging: Major foods—insects represent more than 90% of diet, wild fruits form the remainder. Substrate—leaf surfaces. Technique—leaf gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, or white pine / red oak / red maple, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Not available.

Ovenbird (*Seiurus aurocapillus*)

Goal Description

The user wishes to create or enhance habitat for the ovenbird.

Species Information—Species information includes the following:

Range: Breeding—central Canada and the northeastern United States, south in the mountains to Georgia. Winter—Florida, west to Mexico, south to Central America, the West Indies and northern South America.

Relative abundance in New England: Common.

Habitat: Breeding—usually in closed-canopy, mature deciduous or mixed woods, but often among pines; open forests with little underbrush and an abundance of fallen leaves, logs, and rocks are preferred; thinning may reduce ovenbird abundance until the canopy closes.

Nest site: On ground (sloped or level), in depression of dead leaves, and sometimes at base of tree or log, invariably roofed over and concealed from above by vegetation.

Territory size: 0.2 to 1.8 ha per pair; 21 territories averaged 0.6 ha, range 0.1 to 1.2 ha. Habitat—hemlock-beech.

Sample densities: In Maryland, 40 territorial males per 40 ha in mixed oak forest; 26 territorial males per 40 ha in dense second growth; 24 territorial males per 40 ha in young second growth (resulting from cutting); 17 territorial males per 40 ha in pine-oak forest.

Foraging: Major foods—insects such as plant lice, caterpillars (hairy and hairless), other larvae, moths, butterflies, grasshoppers, and crickets; also consumes small snails, slugs, myriapods, earthworms, and spiders. Substrates—leaf litter and debris of forest floor. Techniques—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Not available.

Philadelphia Vireo (*Vireo philadelphicus*)

Goal Description

The user wishes to create or enhance habitat for the Philadelphia vireo.

Species Information—Species information includes the following:

Range: Breeding—New Brunswick, west to Alberta, south to northern New England (rarely), Michigan and North Dakota. Winter—Central America.

Relative abundance in New England: Uncommon (Maine).

Habitat: Breeding—Deciduous, coniferous or mixed forests, woodland edges, clearings, and burned-over areas with young deciduous second growth, neglected farmlands grown up to small trees and tall shrubs interspersed with clearings, and willow and alder thickets along streams; rarely in villages.

Special habitat requirements: Deciduous trees for nesting.

Nest site: Nest is hung in the fork of a slender horizontal twig of a deciduous tree or shrub.

Foraging: Major foods—insects, especially caterpillars; some wild fruits in autumn (less than 10%). Substrates—leaf surfaces and branches. Techniques—flight-gleaning, gleaning, and hawking. Preferred feeding habitat—tree tops and dense shrubbery.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type is aspen or birch or northern hardwoods or bottomland hardwoods or northern red oak or white pine/red oak/red maple, and
- Size class is regeneration or sapling or pole,

OR

- Deciduous shrub layer > 0 and shrub layer percent cover ≥ 20,

OR

- Deciduous midstory > 25,

OR

- Canopy closure > 15 and ≤ 30.

Treatment Implications

Not available.

Pileated Woodpecker (*Dryocopus pileatus*)

Goal Description

The user wishes to create or enhance habitat for the pileated woodpecker.

Species Information—Species information includes the following:

Range: Breeding—southeastern Canada, northwest to Mackenzie district, Northwest Territories, south to Florida and Texas. Winter—same as breeding range.

Relative abundance in New England: Uncommon.

Habitat: Breeding—extensive second growth and mature coniferous, deciduous, or mixed forests, often in lowlands near rivers and wooded swamps; woodlots near farms and residential areas; prefer areas with high basal area and high stem density. Winter—birds are permanent residents, generally remaining in breeding habitat year round; birds have recently been found breeding in city parks with large trees.

Special habitat requirements: Mature forest with large dead or dying trees greater than 36 cm for nesting and feeding; trees with heart rot that attract carpenter ants, a winter staple.

Nest site: Cavity in trunk of dead or less often, living tree; sometimes in large dead limbs, preferably near water; pileated nests have been found in trees with a dbh range of 33 to 91 cm (average 54.6 cm); they most often nested in trees 36 to 51 cm dbh in oak-hickory woodland and favored trees with smooth trunks and fungal activity; rarely reuse old nest holes.

Sample densities: 3 birds per 40 ha in virgin bottomland forest in Illinois; 3 birds per 40 ha in mature bottomland forest in Illinois; 0 to 0.5 birds per 40 ha in mature upland forest in Illinois; 1 pair per 665 ha in ponderosa pine, Douglas-fir, and larch habitat in Oregon; maximum 1 pair per 40 ha.

Foraging: Major foods—larvae and adults of many kinds of insects, especially ants, which account for more than 50% of the diet; also eats wild fruits, acorns, and beechnuts. Substrates—trunks, bark, branches, and decayed heartwood of living and dead standing trees; most feeding is done in decayed wood. Techniques—drilling and gleaning. Preferred feeding habitat—feeding is restricted to forest interiors and less commonly, edges.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

-
- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Live cavity tree or dead cavity tree = present, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Not available.

Pine Grosbeak (*Pinicola enucleator*)

Goal Description

The user wishes to create or enhance habitat for the pine grosbeak.

Species Information—Species information includes the following:

Range: Breeding—boreal forests of Canada, south to Nova Scotia, northern New England, Manitoba, and the Rocky Mountains. Winter—wanders south irregularly to Maryland, Indiana, and Nebraska.

Relative abundance in New England: Uncommon and irregular.

Habitat: Breeding—northern spruce-fir forests, typically at high elevations, and usually at edge of open area in forest or along forest border. Winter—may remain in breeding areas or move south to open cedar-strewn hillsides, residential areas with feeders, orchards, and street trees.

Special habitat requirements: Coniferous forests.

Nest site: Low in coniferous tree (often spruce) or shrub.

Foraging: Major foods—buds, seeds, some insects in spring and summer. Substrates—ground and branches. Techniques—ground gleaning and budding.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = aspen, birch, bottomland hardwoods, or northern red oak, and
- Size class = regeneration, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Pine Siskin (*Carduelis pinus*)

Goal Description

The user wishes to create or enhance habitat for the pine siskin.

Species Information—Species information includes the following:

Range: Breeding—Quebec, west to Alaska, south to northern New England, North Carolina (mountains); occurs rarely and erratically in northern Pennsylvania, southern New York and southern New England. Winter—breeding range south to Florida, the Gulf States and Mexico.

Relative abundance in New England: Uncommon in breeding season; abundant to rare (very irregular) in winter.

Habitat: Breeding—coniferous forests, natural conifer stands or evergreen plantations, alder thickets, and weed patches adjacent to forest.

Special habitat requirements: Conifers.

Nest site: Usually nests in loose colonies; nest is usually on a horizontal branch of a conifer and well out from the trunk; nests exclusively in conifers.

Territory size: Small area 0.9 to 1.8 m in diameter surrounding nest.

Foraging: Major foods—in summer, insects, buds, seeds, and tender leaves. In winter, seeds of annual weeds, conifers, birches, and alders. Substrates—ground and cone-bearing branches, especially in tops of trees. Technique—ground gleaning and opening seed heads.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, white pine/red oak/red maple, or white pine, and
- Ericaceous shrub layer cover > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Pine Warbler (*Dendroica pinus*)

Goal Description

The user wishes to create or enhance habitat for the pine warbler.

Species Information—Species information includes the following:

Range: Breeding—southern edge of Canada to the Gulf States. Winter—in the southern third of breeding range; some strays may be found as far north as Massachusetts.

Relative abundance in New England: Locally common to rare. Breeding—exclusively in pines and favoring open pitch pine woods with tall trees; frequents coastal pine barrens, less common inland. Winter—mature loblolly pine stands, especially those near tidewater.

Special habitat requirements: Pines; pitch pine is preferred but other species of pine are used as well.

Nest site: Saddled on a horizontal branch well out from the trunk; sometimes situated among the small twigs towards the end of a limb, obscured from below by a cluster of pine needles.

Sample densities: In Maryland, 76 territorial males per 40 ha in immature loblolly-shortleaf pine stand; 20 territorial males per 40 ha in pine-oak forest; 10 territorial males per 40 ha in mature scrub pine.

Foraging: Major foods—includes insects, adult and larvae of beetles, ants, grasshoppers, moths, bugs, flies, and scale insects; also takes spiders and small amounts of pine and birch seeds, and berries of wax myrtle. Substrates—trunks and larger branches of pines. Techniques—trunk and branch gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = white pine/red oak/red maple, or white pine, and
- Canopy closure > 30%.

Treatment Implications

Not available.

Prothonotary Warbler (*Protonotaria citrea*)

Goal Description

The user wishes to create or enhance habitat for the prothonotary warbler.

Species Information—Species information includes the following:

Range: Breeding—southeastern Minnesota and northeastern Nebraska, east to southern Ontario, central New York, and central New Jersey, south to Florida. Winter—Nicaragua to Columbia.

Relative abundance in New England: Uncommon to rare.

Habitat: Breeding—wooded swamps, borders of streams and shallow ponds and flooded bottomlands often heavily shaded with oak, maple, ash, and elm.

Special habitat requirements: Cavity for nesting; border between water and thick deciduous woods.

Nest site: Natural cavities, abandoned woodpecker holes or nest boxes; almost always in well shaded stumps or snags that are standing in water or less than 6 m from it; male builds one or two dummy nests.

Territory size: Linear, 240 to 300 m of woody vegetation at water's edge; an area 168 m long by 61.0 m wide was occupied by one male (Tennessee). Habitats—grassy terraces (with several nesting boxes); rivers banks densely covered with small trees and bushes.

Sample densities: 40 territorial males per 40 ha in second-growth river swamp in Maryland; maximum 27 pairs per 40 ha.

Foraging: Major foods—caterpillars, ants, flies, bees, locust, aquatic insects, beetles, spiders, and small snails. Substrates—trunks and branches of trees. Techniques—trunk and branch gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present.

Treatment Implications

Not available.

Purple Finch (*Carpodacus purpureus*)

Goal Description

The user wishes to create or enhance habitat for the purple finch.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to British Columbia, south to the mountains of Maryland, Illinois, and the mountains of California. Winter—northern New England, west to Wisconsin, south to Georgia and Texas, British Columbia, south to southern California and Arizona.

Relative abundance in New England: Common (Maine) to uncommon (southern Connecticut).

Habitat: Breeding—edges of coniferous forests, evergreen plantations, and ornamental conifers in residential areas, parks, open mixed woodlands. Winter—largely deciduous woodlands; common at feeding stations.

Special habitat requirements: Coniferous trees.

Nest site: Typically on horizontal branch of a conifer (commonly spruce), often near top of tree.

Foraging: Major foods—over 70% vegetable matter, especially seeds of conifers, weeds and grasses, buds, and fruits; also takes insects, spiders, and other small invertebrates. Substrates—branches. Technique—branch gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Currently, there are no DFCs developed for this species. Thus, NED-2 will always assume that any stand, regardless of conditions, will support purple finch.

Treatment Implications

Not available.

Purple Martin (*Progne subis*)

Goal Description

The user wishes to create or enhance habitat for the purple martin.

Species Information—Species information includes the following:

Range: Breeding—Prince Edward Island, west to southern British Columbia, south to central Mexico. Winter—Brazil.

Relative abundance in New England: Common at local nest sites, and rare elsewhere.

Habitat: Breeding—farmlands, parks, suburban yards, and preferably near water.

Special habitat requirements: Large multi-roomed nest boxes, and open space for foraging; may occasionally use natural cavities in trees.

Nest site: Originally nested in cavities in trees; today nests almost exclusively in nest boxes, preferably near water; birds favor large multi-roomed birdhouses set on poles 4.6 to 6.1 m high; easily driven out of nest sites by starlings and house sparrows.

Territory size: Restricted to the nest cavity.

Sample densities: Colonies may consist of as many as 200 pairs.

Foraging: Major foods—flying insects. Substrate—air. Techniques—hawking and skimming water surface.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Dead cavity tree = present.

Treatment Implications

Not available.

Red-bellied Woodpecker (*Melanerpes carolinus*)

Goal Description

The user wishes to create or enhance habitat for the red-bellied woodpecker.

Species Information—Species information includes the following:

Range: Breeding: New Jersey, Pennsylvania, New York, west to southern Minnesota, south to the Gulf Coast; occasionally breeds in southern New England. Winter—same as breeding range.

Relative abundance in New England: Locally common to rare.

Habitat: Breeding—Deciduous and coniferous forests and edges; frequents uplands but prefers bottomlands, woodlots near farms and villages and orchards; favors dead limbs in living trees for nest sites. Winter—similar to breeding habitat; birds are sedentary, remaining on breeding grounds year-round.

Special habitat requirements: Extensive mature woodlands with dead trees or trees with large dead limbs for nesting.

Nest site: Cavity in sound or soft wood, often in limb at edge of woodland, less often in trunk of dying or dead tree, building, utility pole, or stump; frequently uses nesting boxes; may excavate a cavity or occupy an existing one.

Territory size: Average 2.5 ha (3 territories) in virgin floodplain forest in Illinois; average 1.8 ha (2 territories) in mature upland forest in Illinois. Winter—1.2 to 1.6 ha.

Sample densities: 23 birds per 40 ha in virgin floodplain (elm-maple) forest in Illinois; 6 birds per 40 ha in bottomland forest in Illinois; 19 pairs per 40 ha in white oak and yellow-poplar forest in Maryland.

Foraging: Major foods—insects, especially ant and beetles; beech and acorn mast, corn, and wild fruits. Substrates—upper dead limbs of trees and ground. Techniques—scaling, probing, gleaning tree surfaces, drilling, and ground foraging. Preferred feeding habitat—lowlands; birds may seek food in areas outside of breeding habitat.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, bottomland hardwoods, northern red oak, white pine / red oak / red maple, or white pine, and
- Size class = small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Red-breasted Nuthatch (*Sitta canadensis*)

Goal Description

The user wishes to create or enhance habitat for the red-breasted nuthatch.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to Alaska, south to New Jersey, North Carolina (mountains) and southern California. Winter—northern United States, irregularly south to Florida, the Gulf Coast and northern Mexico.

Relative abundance in New England: Common (Maine).

Habitat: Breeding—coniferous forests, sometimes in mixed woodlands. Winter—mainly coniferous forests but also frequents mixed woodlands with cone-bearing trees; less often in deciduous woods (winter only).

Special habitat requirements: Coniferous woods and cavity for nesting in tree with minimum dbh of 30.5 cm.

Nest site: A cavity in a rotted stub or dead branch, usually excavated but occasionally uses an old woodpecker hole.

Foraging: Major foods—small insects and seeds (especially of pine, spruce, and fir). Substrates—mainly along twigs and small branches. Techniques—gleaning and probing.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present.

Treatment Implications

Not available.

Red-eyed Vireo (*Vireo olivaceus*)

Goal Description

The user wishes to create or enhance habitat for the red-eyed vireo.

Species Information—Species information includes the following:

Range: Breeding—Quebec, west to British Columbia, south to Florida and southern South America. Winter—South America.

Relative abundance in New England: Abundant.

Habitat: Breeding—open deciduous and second-growth woodlands (less often in mixed woods) with thick undergrowth of saplings; frequents residential areas with abundant shade trees that provide a continuous canopy; ubiquitous and common in deciduous woodland, yet shows preference for mesic stands in the deciduous forest.

Special habitat requirements: Deciduous trees; a continuous canopy rather than presence of an understory may be the chief habitat requirement.

Nest site: Suspended in the fork of a horizontal limb often in a sapling, usually in a peripheral area of canopy.

Territory size: 45 territories in Michigan averaged 0.7 ha per pair; 5 territories in mixed woods in Ontario ranged from 0.3 to 1.2 ha (average 0.6 ha).

Sample densities: In Maryland, 60 territorial males per 40 ha in mature northern hardwoods forest; 100 territorial males per 40 ha in virgin hardwood deciduous forest; 52 territorial males

per 40 ha in dense second-growth forest; 34 territorial males per 40 ha in pine-oak forest; 10 territorial males per 40 ha in open slash area.

Foraging: Major foods—insects (more than 85% of diet), mainly caterpillars, moths, beetles, bugs, and ants. Substrates—leaf surfaces, especially undersides. Techniques—gleaning, flight-gleaning, hawking (uncommon); glides rather than hops from branch to branch. Preferred feeding habitat—uppermost branches of trees; most feeding occurs in periphery of middle and upper canopy; little feeding takes place in core.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, and
- Size class = regeneration, and
- Canopy closure > 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration or uneven-age, and
- Canopy closure > 70%.

OR

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Red-headed Woodpecker (*Melanerpes erythrocephalus*)

Goal Description

The user wishes to create or enhance habitat for the red-headed woodpecker.

Species Information—Species information includes the following:

Range: Breeding—southwestern Quebec, west to southeastern Alberta, south to the Gulf Coast; does not breed in northern New England. Winter—southeastern Pennsylvania, west to Oklahoma and south

Relative abundance in New England: Uncommon to rare.

Habitat: Breeding—lowland and upland habitats, river bottoms, wooded swamps, beaver ponds, open deciduous woods, groves of dead and dying trees, orchards, and open agricultural country; prefers savanna-like grasslands with scattered trees and forest edges; woodlots used for nesting in southwestern Virginia ranged from 0.5 to 20.0 ha. Winter—birds move from forest interior; oaks and maples that provide mast may be important components of winter habitat.

Special habitat requirements: Prefers open areas with snags and lush herbaceous ground cover.

Nest site: Tree cavity usually excavated in dead tree or limb without bark that is surrounded by open space, utility poles, and avoids bird houses; favors cavities in trunks rather than limbs; prefers open woods with dead trees and herbaceous ground cover.

Territory size: In winter the birds restrict their activities to small, well-defined territories.

Sample densities: Sample includes 9 to 12 birds per 40 ha in bottomland woods with much edge and large internal openings (oak-hickory-hackberry-elm community); 25 birds per 40 ha in suburban-residential habitat; 28 birds per 40 ha in shrub area.

Foraging: Major foods—insect larvae and adults, wild fruits, acorns (especially those of pin oak), beechnuts, and corn. Substrates—ground, trunks, and limbs. Techniques—drilling, probing, ground gleaning, and hawking. Preferred feeding habitat—open areas adjacent to woodlots; upper parts of trees in winter.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, and
- Size class = regeneration or large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Ground layer percent cover > 75%, and
- Live cavity tree or dead cavity tree = present, and
- 15 < canopy closure ≤ 30%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Ground layer percent cover > 75%, and
- Live cavity tree or dead cavity tree = present, and
- 15 < canopy closure ≤ 30%, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Red-shouldered Hawk (*Buteo lineatus*)

Goal Description

The user wishes to create or enhance habitat for the red-shouldered hawk.

Species Information—Species information includes the following:

Range: Breeding—Throughout the eastern United States. Winter—southern New England, west to Michigan.

Relative abundance in New England: Uncommon.

Habitat: Breeding—moist hardwood or mixed woodlands, wooded swamps, bottomlands and wooded margins of marshes often close to cultivated fields; rare in mountains. Winter—same as breeding habitat.

Special habitat requirements: Cool, moist, and lowland forests with tall trees for nesting.

Nest site: Shows little preference for any one species of tree for nesting but usually chooses one that is tall; nest is typically placed in a main fork close to trunk; may repair and use old nest but usually builds new one; birds show strong attachment to nest site by returning year after year.

Home range: In Kansas, 72.9 ha in Kansas and 0.07 to 1.6 km^2 in Michigan; winter ranges in Michigan were usually between 3.8 to 5.2 km^2.

Sample densities: 1 pair per 2.1 km^2 in floodplain forest in Maryland; about 1 pair per 48.6 ha of floodplain in Maryland.

Foraging: Major foods—amphibians, reptiles, crustaceans (crayfish), insects, and mammals such as small rodents, shrews, and moles; also takes young birds of many species. Substrates—forest floor and meadow grasses. Techniques—hawking (while soaring or sallying from a perch), diving to ground, and pouncing. Preferred feeding habitat—in addition to foraging in nesting habitat, birds hunt in drier woodland clearing and fields.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, and
- Size class = small sawtimber, or large sawtimber, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration, small sawtimber, large sawtimber, or uneven-age, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = eastern hemlock, and
- Size class = large sawtimber, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Not available.

Red-tailed Hawk (*Buteo jamaicensis*)

Goal Description

The user wishes to create or enhance habitat for the red-tailed hawk.

Species Information—Species information includes the following:

Range: Breeding—Alaska and Canada, south to Central America and the West Indies. Winter—withdraws from northern portions of breeding range to central New England and southern Michigan, south.

Relative abundance in New England: Common (Massachusetts) to uncommon (Maine) in breeding season; locally common to uncommon in winter.

Habitat: Breeding—deciduous and mixed woodlands interspersed with meadows, brushy pastures, open bogs, and swampy areas; common to both the cold-temperature conifer forests and temperate deciduous woodlands. Winter—similar to breeding habitat.

Special habitat requirements: Large trees for nesting and perching.

Nest site: Usually in a tall tree in or at the edge of a woodland, or in isolated tree in an open situation; oak or white pine is often used as nest tree in Massachusetts; in New York, beech, birch, and maple are commonly used.

Territory size: 32.4 to 81.0 ha (excluding peripheral areas) in California.

Home Range: Breeding season—0.8 to 5.6 km^2 in Wyoming and Michigan, respectively. Winter—ranges of up to 10.4 km^2 were measured in Michigan.

Sample densities: 1 pair per 5.7 km^2 in deciduous woodland in New York; 1 pair per 10.6 km^2 in fields and woodlands; 1 pair per 1.3 km^2 in pine-oak habitat in California.

Foraging: Major foods—small mammals, especially rodents such as meadow mice, chipmunks, and squirrels; also takes amphibians, reptiles, nestling birds, insects, and carrion; occasionally kills domestic animals. Substrates—short meadow grasses. Techniques—soaring, diving, and pouncing. Preferred feeding habitat—open field with short grasses and weeds and scattered trees for perching.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- Canopy closure ≤ 15% or canopy closure > 70%, and
- High perch = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration, small sawtimber, large sawtimber, or uneven-age, and
- Canopy closure ≤ 15% or canopy closure > 70%, and
- High perch = present.

Treatment Implications

Not available.

Rose-breasted Grosbeak (*Pheucticus ludovicianus*)

Goal Description

The user wishes to create or enhance habitat for the rose-breasted grosbeak.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to Manitoba, south to central New Jersey, Georgia (mountains) and the lower Midwest. Winter—Mexico to South America.

Relative abundance in New England: Common.

Habitat: Breeding—edges of moist deciduous second-growth woods, wooded borders of swamps and streams, thickets, suburban trees, and old orchards.

Special habitat requirements: An edge; ideal habitat is the interface of tall forest trees and fields with dense high shrubs and tangles.

Nest site: Usually built in the fork of a deciduous tree; less commonly placed in a deciduous or evergreen shrub.

Foraging: Major foods—insects and spiders (about 50%); the balance of diet is seeds and fruits. Substrates—ground and tree canopy. Techniques—ground, twig, and leaf gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%.

OR

- HAM forest type = balsam fir, spruce-fir, eastern hemlock, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and

- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%.

Treatment Implications

Not available.

Ruby-crowned Kinglet (*Regulus calendula*)

Goal Description

The user wishes to create or enhance habitat for the ruby-crowned kinglet.

Species Information—Species information includes the following:

Range: Breeding—Quebec west to Alaska, south to northern Maine, Adirondacks of New York, Ontario, New Mexico and southern California. Winter—southern New England, west to British Columbia, south to southern Florida and Central America.

Relative abundance in New England: Common to uncommon.

Habitat: Breeding—northern coniferous forests in pure or mixed stands of spruce, fir, tamarack or pine, forest edges, open stands, and bogs. Winter—coniferous or deciduous forest understory, open or edge situations, especially in dry oak woodland.

Nest site: Nest is usually well concealed in coniferous shrub or tree at tip of horizontal branch, typically in spruce.

Foraging: Major foods—insects (summer), insects supplemented with seeds and fruit (winter). Substrates—leaf litter; leaves and stalks of herbaceous plants; bark of twigs, branches, and trees; clusters of needles. Techniques—hawking, gleaning, and hover-gleaning. Preferred feeding habitat—in winter, birds forage close to the ground, frequenting thickets and saplings in deciduous as well as coniferous woodlands.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Canopy closure > 70%.

OR

- HAM forest type = white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Ruby-throated Hummingbird (*Archilochus colubris*)

Goal Description

The user wishes to create or enhance habitat for the ruby-throated hummingbird.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to southern Alberta, south to Florida and Texas. Winter—Mexico and Central America.

Relative abundance in New England: Common.

Habitat: Breeding—mixed woodlands, shade trees in residential landscapes, and orchards; often near streams and wooded swamps.

Special habitat requirements: Abundant flowers, preferably red.

Nest site: Nest is usually built in the saddle of a drooping limb of a shrub or tree often near, and sometimes directly over water or near a woodland trail; it is usually sheltered above by leaves and branches and exposed to the ground below.

Territory size: Female alone defends immediate area of surrounding nest; a male in Ohio defended a feeding territory of 0.1 ha.

Sample densities: In Maryland, 15 pairs per 40 ha in well drained floodplain forest; 8 pairs per 40 ha in upland oak forest; 6 pairs per 40 ha in mature northern hardwoods forest; 4 pairs per 40 ha in hedgerows and active and abandoned farmland.

Foraging: Major foods—small insects, nectar, and sap. Substrate—flowers. Techniques—hovering and hawking. Preferred feeding habitat—wherever there are abundant flowers.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- 30 < canopy closure ≤ 70%.

Treatment Implications

Not available.

Ruffed Grouse (*Bonasa umbellus*)

Goal Description

The user wishes to create or enhance habitat for the ruffed grouse.

Species Information—Species information includes the following:

Range: Breeding—southern Quebec, west to Alaska, south to Virginia and the mountains of northern Georgia. Winter—same as breeding range.

Relative abundance in New England: Common to uncommon.

Habitat: Breeding—Broods prefer areas with dense woody cover overhead and fairly open herbaceous ground cover; broods frequent regenerating stands of aspen, birch, and other hardwoods; alder thickets, recently logged areas next to shrubby wetlands, and abandoned farmlands in the shrub and sapling stage are particularly attractive to broods; in extensive stands of pole and sawtimber, broods frequent logging roads, small clearings, and recently disturbed sites. Winter—daytime activity usually occurs in shrubby thickets and dense stands of hardwood saplings; birds prefer to roost in snow burrows in open pole-size hardwood stands; when snow is unsuitable for roosting, birds concentrate in dense brush or closed-canopy conifer stands.

Special habitat requirements: Drumming logs in hardwood saplings, small poles, brushy escape cover, hardwood stands for nesting and feeding, and sunny openings for dusting; strongly associated with the aspen type, especially in the Lake states; grouse also occur in New England woodlands in which aspens exist only as scattered trees, or are absent; old orchards are ideal fall habitat in New England.

Nest site: Usually on dry ground in dense cover in the shelter of a fallen log, rock, root, or low-hanging conifer limb near the base of a tree; very often located at edge of a path or clearing and close to a source of water.

Home range: For males, the home range may be as small as 2.4 to 4.0 ha.

Sample densities: Maximum density under optimum conditions seems to be about 1 pair per 2.4 to 3.2 ha.

Foraging: Major foods—seeds, insects, fruit, leaves, buds of birch, aspen, hazel, hop-hornbeam, and cherry are staples in fall and winter. Substrate—leaf litter. Techniques—scratching and pecking and browsing. Preferred feeding habitat—aspen stands are favorite feeding spots in winter especially in the boreal forest zone.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Ground layer percent cover > 75%, and
- 15 < canopy closure ≤ 70%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = bottomland hardwoods, and
- Size class = regeneration, sapling, or pole, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Ground layer percent cover > 75%, and
- 15 < canopy closure ≤ 70%, and
- Soft mast or hard mast = present.

Treatment Implications

Treatments may include the following:

- Maintaining a variety of conditions across a small area;
- Maintaining areas with a high number of stems and a high canopy closure along with trees and shrubs that produce mast and fruit, and dead and down material;
- Maintaining areas with at least pole-sized trees, 30 to 70% canopy closure, and mast and fruit producing trees, along with pockets of conifers; and
- Maintaining permanent forest openings dominated by herbaceous plants.

Rufous-sided Towhee (*Pipilo erythrophthalmus*)

Goal Description

The user wishes to create or enhance habitat for the rufous-sided towhee.

Species Information—Species information includes the following:

Range: Breeding—Central Maine, west to southeastern Saskatchewan, south to Florida, northern Louisiana and Oklahoma. Winter—southern New England, west to southern British Columbia, south to Florida, Mexico, and southern California. Absent from mountains.

Relative abundance in New England: Common in breeding season; uncommon in winter (Connecticut coast).

Habitat: Breeding—woodland edges and dry open interiors and clearings, hedgerows, roadside thickets, brushy hillsides, and pastures. Winter—similar to breeding habitat.

Special habitat requirements: Dense brushy cover.

Nest site: On or near ground in brushy cover or low in a shrub.

Sample densities: Sample includes 40 pairs per km^2 in favorable habitat in North Dakota; 50 territorial males per 40 ha in dry deciduous scrub; 33 territorial males per 40 ha in open slash area; 32 territorial males per 40 ha in young second-growth (following cutting); 6 territorial males per 40 ha in young second-growth (following cutting); 6 territorial males per 40 ha in pine-oak forest.

Foraging: Major foods—insects, seeds, fruits, and mast. Substrate—leaf litter of forest floor. Techniques—scratching, gleaning, and scattering leaves with beak.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, white pine/red oak/red maple, or white pine, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure≤ 15%, and
- Percent cover of leaf litter ≥ 30%, and
- Soft mast = present.

OR

- HAM forest type = birch, northern hardwoods, bottomland hardwoods, or northern red oak, and
- Size class = regeneration, sapling, or pole, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%, and
- Percent cover of leaf litter ≥ 30%, and
- Soft mast = present.

Treatment Implications

Treatments may include the following:

- Maintaining brushy conditions;
- Maintaining trees and shrubs that produce mast and fruit; and
- Maintaining an open canopy.

Rusty Blackbird (*Euphagus carolinus*)

Goal Description

The user wishes to create or enhance habitat for the rusty blackbird.

Species Information—Species information includes the following:

Range: Breeding—northern Quebec and southern Canadian Provinces, west to Alaska, south to northern New England and the Adirondack Mountains of New York. Winter—southern New England, south to Florida, Ohio River Valley, west to Colorado, south to Texas.

Relative abundance in New England: Common (northern Maine) to uncommon (northern Vermont) during breeding season; rare and local (Connecticut, southeastern Massachusetts) in winter; more common southward.

Habitat: Breeding—wooded swamps, tree-bordered marshes, beaver ponds, muskegs, boreal bogs, and stream borders with alder and willow thickets, wooded islands in lakes; rarely seen in fields with other black birds. Winter—wooded swamps.

Nest site: Solitary nester; nest is often in dense foliage of young conifers, especially balsam and spruce; also builds in deciduous shrubs in marshes such as sweet gale and buttonbush.

Territory size: Breeding territories are sometimes large; nests may be 0.8 km or more apart.

Foraging: Major foods—insects, seeds of weeds, grains, and wild fruits. Technique—ground gleaning. Preferred feeding habitat—open areas and grassy edges of northern ponds and streams.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%.

OR

- HAM forest type = balsam fir, spruce-fir, or red spruce, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%.

Treatment Implications

Not available.

Scarlet Tanager (*Piranga olivacea*)

Goal Description

The user wishes to create or enhance habitat for the scarlet tanager.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west through eastern Maine to southern Saskatchewan, south to the coast of Virginia and southern Kansas. Winter—South America.

Relative abundance in New England: Common and widespread.

Habitat: Breeding—mature deciduous and mixed woodlands, roadside shade trees; often in pine-oak and oak-hickory woodlands; 68% of 28 nests in oak-hickory woods and tamarack swamp were in trees with a dbh greater than or equal to 23 cm.

Special habitat requirements: Deciduous or mixed woodlands.

Nest site: Usually placed well out from trunk on a horizontal branch in a leaf cluster or position where it is shaded from above and open to the ground below; it is usually placed where it can be approached by unobstructed flyways from adjacent trees.

Sample densities: 26 territorial males per 40 ha in virgin central hardwood deciduous forest; 15 territorial males per 40 ha in mature hardwood forest; 14 territorial males per 40 ha in dense second-growth (oak-maple forest).

Foraging: Major foods—insects and fruits. Substrates—leaves and twigs of outer tips of limbs and dead branches. Techniques—twig and leaf gleaning and flight-gleaning. Preferred feeding habitat—canopy of forest trees.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, and
- Size class = small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

OR

- HAM forest type = birch, bottomland hardwoods, eastern hemlock, northern red oak, or white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Canopy closure > 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Canopy closure > 70%.

OR

- HAM forest type = white pine, and
- Size class = sapling, pole, small sawtimber, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Sharp-shinned Hawk (*Accipiter striatus*)

Goal Description

The user wishes to create or enhance habitat for the sharp-shinned hawk.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, south to Georgia (mountains), and west. Winter—central New England, west to Ohio and south.

Relative abundance in New England: Uncommon (Maine) in breeding season; uncommon to rare in winter.

Habitat: Breeding—open mixed or coniferous woodlands, clearing, and edges; a bird of cold-temperature conifer forests and temperate deciduous woodlands. Winter—same as breeding habitat.

Special habitat requirements: Extensive open mixed woodlands that are free from human disturbance.

Nest site: Most often in a conifer (white pine in Massachusetts, hemlock in New York); seldom in a deciduous tree (oak, beech); nest is typically placed on a limb against the trunk of a medium tree and is well concealed; nest tree is often at the edge of a clearing; sometimes repairs and uses an old nest.

Home range: 0.26 to 0.51 mi^2 in Moose, Wyoming.

Foraging: Major foods—small to medium birds (staple); small mammals, mainly rodents, shrews, moles and young lagomorphs. Substrates—forest floor, meadow grasses, and bushy pastures. Techniques—hawking, diving to ground, and pouncing. Preferred feeding habitat—generally forages over open country, avoids hunting in heavily wooded areas.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Canopy closure > 70%.

Treatment Implications

Not available.

Solitary Vireo (*Vireo solitarius*)

Goal Description

The user wishes to create or enhance habitat for the solitary vireo.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to British Columbia, south to Connecticut (uplands), Georgia (mountains), central Minnesota and Mexico (mountains). Winter—South Carolina to Central America.

Relative abundance in New England: Common (Maine) to uncommon (southern Connecticut).

Habitat: Breeding—coniferous or mixed woodlands especially those with openings in canopy and a dense understory; shows preference for pine, hemlock, or spruce; prefers mountain elevations but occurs locally in highlands.

Nest site: Suspended from a forked horizontal branch, usually a conifer.

Sample densities: Average 29 birds per 40 ha in ponderosa pine forest in Colorado; 27 territorial males per 40 ha in virgin hemlock forest in Maryland; 17 territorial males per 40 ha in mature northern hardwoods forest in Maryland.

Foraging: Major foods—insects, especially moths and caterpillars, and small amounts of fruits. Substrates—bark of branches, often at bases of horizontal branches and dead stubs. Techniques—gleaning, hover-gleaning, and hawking. Preferred feeding habitat—lower and middle canopy.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Coniferous shrub layer > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = bottomland hardwoods, or white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- Coniferous shrub layer > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = balsam fir, red spruce, eastern hemlock, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coniferous shrub layer > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = spruce-fir, and
- Coniferous shrub layer > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = northern red oak, and
- Size class = small sawtimber, and
- Coniferous shrub layer > 0%, and
- Coniferous midstory cover > 25%, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Song Sparrow (*Melospiza melodia*)

Goal Description

The user wishes to create or enhance habitat for the song sparrow.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to southern Alaska, west to coast to North Carolina and mountains of northern Georgia; also to Missouri and Mexico. Winter—New Brunswick, west to Wisconsin and British Columbia, south to Florida and the Gulf States.

Relative abundance in New England: Abundant.

Habitat: Breeding—brushy fields, swamps, forest edges, roadsides, hedgerows, farms, suburbs, cities, and shores of ponds and streams; tolerates a wide range of habitat conditions; prefers wet lowland situations with low, irregular plant growth and abundant sunlight. Winter—similar to breeding habitat.

Special habitat requirements: Song posts (elevated perches).

Nest site: Early nests are usually on ground and are typically well hidden in grasses or weeds or concealed under a bush or brush pile; subsequent nests may be on ground or elevated in a shrub;

may raise height of successive nests with the growth of herbaceous vegetation; *Rosa multiflora* and *Rubus spp*. are preferred nest site vegetation.

Territory size: Ranges from 0.2 to 0.6 ha in favorable habitat; from 167 to 822 mi^2 on an island off British Columbia.

Home range: Resident birds in winter may range over an area 6 to 10 times as large as territory.

Sample densities: In Maryland, 21 territorial males per 7.8 ha in shrubby field; 3 territorial males per 3.8 ha in open hemlock-spruce bog; 4.5 territorial males per 8.3 ha in infrequently mowed apple orchard.

Foraging: Major foods—insects, weed seeds, and fruits. Substrates—grasses and stems and twigs of bushes. Techniques—ground and herb and twig gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = large sawtimber, and
- Ground layer percent cover > 75%, and
- Shrub layer percent cover ≤ 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Low perch = present.

OR

- HAM forest type = bottomland hardwoods, or
- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Shrub layer percent cover ≤ 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Low perch = present.

Treatment Implications

Not available.

Summer Tanager (*Piranga rubra*)

Goal Description

The user wishes to create or enhance habitat for the summer tanager.

Species Information—Species information includes the following:

Range: Occurs mainly in central and southern United States to northern Mexico, occasionally in the southwestern Allegheny Plateau Province of Pennsylvania.

Relative abundance in New England: Common in its southern range; occasionally occurs in Pennsylvania, but rare spring migrant to New England.

Habitat: Deciduous or mixed forests sapling-pole size or larger.

Special habitat requirements: Ericaceous shrubs and dense overstory cover.

Nest Site: Unreported.

Sample Densities: Unreported.

Foraging: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Province (ignored) = Allegheny Plateau, and
- Ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Swainson's Thrush (*Catharus ustulatus*)

Goal Description

The user wishes to create or enhance habitat for the Swainson's thrush.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to Alaska, south to northern New England, Pennsylvania, Colorado, and southern California; rarely in mountains of West Virginia and Maryland. Winter—Central and South America.

Relative abundance in New England: Common (Maine).

Habitat: Breeding—spruce-fir forests especially in low damp areas near water; occurs in both young stands and mature forest; prefers forest interiors to edges; occasionally breeds in mixed woodlands.

Special habitat requirements: Coniferous or mixed forests.

Nest site: Usually in a crotch close to trunk or on a horizontal limb of a spruce or fir tree.

Foraging: Major foods—insects and wild fruits. Substrates—forest floor, foliage and branch surfaces, often high in trees. Techniques—ground gleaning and hawking. Preferred feeding habitat—forest interior, mainly in trees.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Coniferous shrub layer > 0%, and
- Coniferous midstory cover > 25%.

OR

- HAM forest type = birch, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coniferous shrub layer > 0%, and
- Coniferous midstory cover > 25%.

Treatment Implications

Not available.

Tennessee Warbler (*Vermivora peregrina*)

Goal Description

The user wishes to create or enhance habitat for the Tennessee warbler.

Species Information—Species information includes the following:

Range: Breeding—northern border of United States, south to northern Wisconsin, northern Michigan, northeastern New York, southern Vermont, central New Hampshire, southern Maine. Winter—from Guatemala, east to western Colombia and northern Venezuela.

Relative abundance in New England: Common (Maine).

Habitat: Breeding—associated with openings in northern deciduous or mixed woodlands with grasses, dense shrubs, and scattered clumps of young deciduous trees; often in boggy areas, occasionally on dry pine lands.

Special habitat requirements: Brushy, semi-open country.

Nest site: On moist ground, in moss or grass, often at base of shrub; usually well concealed.

Foraging: Major foods—almost entirely insectivorous, takes weevils, flies, plant lice, grasshoppers, caterpillars, grubs, beetles, spiders, and some fruit. Substrates—the terminal foliage of trees, generally feeding to 12.2 m high. Techniques—branch hopping and foliage gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = balsam fir, or red spruce, and
- Size class = sapling or pole, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer or coniferous shrub layer > 0%.

OR

- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer or coniferous shrub layer > 0%.

Treatment Implications

Not available.

Tree Swallow (*Tachycineta bicolor*)

Goal Description

The user wishes to create or enhance habitat for the tree swallow.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to northern Alaska, south to Maryland, Virginia, Colorado, and California. Winter—coastal areas from Virginia, south to Mexico, Central America and southern California; a few winter as far north as Long Island.

Relative abundance in New England: Abundant.

Special habitat requirements: Cavity for nesting; open feeding areas such as meadows, marshes, or water; the minimum dbh of suitable nest trees is 25.4 cm.

Nest site: Natural cavity or old woodpecker hole in a trunk or dead limb of dead or living tree, holes in buildings, and nest boxes; usually a solitary nester but may nest in small groups where suitable cavities abound and there is a good food supply; prefers to nest over a body of water.

Territory size: Territory is restricted to the nest site.

Sample densities: Sample includes 40 occupied nest boxes in 11.3 ha of modified woodland in Illinois; birds will nest within 2.1 m of each other in the presence of abundant food; densities of up to 150 pairs per 0.3 ha are possible in nest boxes spaced no less than 2 m apart.

Foraging: Major foods—flying insects (summer), berries, and seeds are taken to supplement the winter diet when insects are less abundant. Substrates—air and water. Techniques—hawking and skimming water surface. Preferred feeding habitat—over bodies of water.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods.

OR

- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Live cavity tree or dead cavity tree = present.

Treatment Implications

Not available.

Tufted Titmouse (*Parus bicolor*)

Goal Description

The user wishes to create or enhance habitat for the tufted titmouse.

Species Information—Species information includes the following:

Range: Breeding—central New England, west to Illinois and northern Nebraska, south to Florida, the Gulf Coast and Texas; increasing and spreading north in the northeast. Winter—same as breeding range.

Relative abundance in New England: Common except at limits of range.

Habitat: Breeding—low rich woodlands, moist bottomlands and swamps, residential areas in shade trees. Winter—same but with preference for feeding stations.

Special habitat requirements: Nesting cavities, commonly in mixed woods.

Nest site: A natural tree cavity or old woodpecker hole; it is generally believed that tufted titmice do not excavate their own nest sites; accept nest boxes.

Territory size: 1.2 ha in oak-hickory-elm habitat in Kansas.

Home range: 5 birds were repeatedly recorded year-round within a 0.9 km radius from a banding station in Michigan; average sizes of minimum home ranges in winter ranged from 4.2 to 8.0 ha. in Kansas.

Sample densities: In Maryland, 13 pairs per 40 ha in well drained floodplain forest; 13 pairs per 40 ha upland oak forest; 11 pairs per 40 ha in second-growth river swamp; 6 pairs per 40 ha in pine-oak forest.

Foraging: Major foods—insects, seeds, and fruits, especially mast. Substrates—branch and leaf surfaces (spring and summer), branch surfaces (winter); ground, especially exposed soil. Techniques—gleaning and probing. Preferred feeding habitat—often in canopy, but very frequently near the ground when not disturbed by observers.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Live cavity tree or dead cavity tree = present.

Treatment Implications

Not available.

Turkey Vulture (*Cathartes aura*)

Goal Description

The user wishes to create or enhance habitat for the turkey vulture.

Species Information—Species information includes the following:

Range: Breeding—central New York, Connecticut and western Massachusetts, west to British Columbia, south to South America. Winter—Maryland and New Jersey, west to Ohio.

Relative abundance in New England: Locally common numbers increasing.

Habitat: Breeding—various habitats, including wet, dry, open, and wooded; wooded habitat is dominated by deciduous or mixed trees. Winter—similar to breeding habitat.

Special habitat requirements: Clearings such as fields and roads in which carrion can be easily sighted.

Nest site: On rocky outcrops or ledges or in rocky caverns, in hollow tree trunks or logs in open deciduous woodlands; eggs are usually well hidden from view and inaccessible to predators; females show attachment to old nest sites.

Sample densities: Probably fewer than 1 bird per km^2 at southern part of range; 0.3 pairs per 40 ha in mixed habitat (forest-brush-farmland) in Maryland.

Foraging: Major foods—carrion of amphibians, reptiles, birds, mammals, and fish; also eats small quantities of plant material. Substrates—so variable that no single substrate can be emphasized except perhaps roadways because of their many road kills. Technique—soaring. Preferred feeding habitat—open fields, ridges.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = regeneration, small sawtimber, large sawtimber, or uneven-age, and
- Dead cavity tree = present, and
- 15 < canopy closure ≤ 70%, and
- High perch = present.

OR

- HAM forest type = bottomland hardwoods, and
- Size class = small sawtimber, or large sawtimber, and
- Dead cavity tree = present, and
- 15 < canopy closure ≤ 70%, and
- High perch = present.

OR

- HAM forest type = northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- Dead cavity tree = present, and
- 15 < canopy closure ≤ 70%, and
- High perch = present.

Treatment Implications

Not available.

Veery (*Catharus fuscescens*)

Goal Description

The user wishes to create or enhance habitat for the veery.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to British Columbia, south to Long Island and central New Jersey, and the mountains of Georgia, and New Mexico. Winter—South America.

Relative abundance in New England: Common.

Habitat: Breeding—low, moist deciduous woods, bottomland forests, wooded swamps, and damp ravines; prefers thickets of early deciduous second-growth and open woods with fairly dense high undergrowth of ferns, shrubs, and trees; avoids mountains.

Special habitat requirements: Moist woodlands with understory of low trees and shrubs.

Nest site: On ground or low in a shrub, tree, or brush pile, often well hidden on a tussock of ferns or other ground cover.

Sample densities: 12 pairs on a 1.2 ha of lake-side forest with laurel understory in New Hampshire; 8 territorial males per 40 ha in virgin hemlock stand.

Foraging: Major foods—nainly insects (about 60%) and wild fruits and seeds (40%). Substrates—forest floor (leaf litter), leaf and branch surfaces in lower canopy. Techniques—ground gleaning and turning leaves with bill.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, and
- Shrub layer percent cover > 20%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration or uneven-age, and

- Shrub layer percent cover > 20%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

OR

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Shrub layer percent cover > 20%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Not available.

Warbling Vireo (*Vireo gilvus*)

Goal Description

The user wishes to create or enhance habitat for the warbling vireo.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia, west to British Columbia, south to North Carolina, northern Mexico and southern California. Winter—South America.

Relative abundance in New England: Locally common to uncommon and widespread.

Habitat: Breeding—open mixed or deciduous woodlands, roadside and village shade trees, river bottoms with mature trees, orchards; avoids high elevations.

Special habitat requirements: Deciduous trees.

Nest site: In horizontal fork of a slender branch usually well away from trunk; typically protected by a canopy of leaves; usually nests higher than other vireos.

Sample densities: 10 territorial males per 40 ha in field with shrubs and stream-bordered trees in Maryland.

Foraging: Major foods—insects and especially caterpillars. Substrates—leaf surfaces. Techniques—flight-gleaning and gleaning. Preferred feeding habitat—middle and upper canopy of tall deciduous trees, largely on branch tips.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- 15 < canopy closure ≤ 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Treatments may include the following:

- Maintaining deciduous trees with large crowns; and
- Maintaining widely spaced trees, where the canopy closure is between 16 to 30%.

Whip-poor-will (*Caprimulgus vociferus*)

Goal Description

The user wishes to create or enhance habitat for the whip-poor-will.

Species Information—Species information includes the following:

Range: Breeding—Nova Scotia and southern Quebec, west to central Saskatchewan, south to eastern Virginia (coast), Alabama, Georgia (mountains), and Texas. Winter—South Carolina, west to the Gulf States and south.

Relative abundance in New England: Locally common to uncommon.

Habitat: Breeding—dry, open, predominantly deciduous woodlands; often with small to medium trees of pine, oak, and beech; less common breeder in mature forests; avoids mountains.

Nest site: Builds no nest; eggs are laid on well-drained ground in the open or under a bush; often among trees at edge of clearing or path.

Territory size: 6 ha, 11.1 ha, 2.8 ha in oak, hickory, and elm woodlands in Kansas.

Sample densities: 1.4 territorial males per 40 ha in upland forest and brush habitat in Maryland.

Foraging: Major foods—mainly flying insects but occasionally takes crickets, ants, and beetles from the ground. Substrates—air and leaf litter. Technique—air screening.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Deciduous shrub layer > 0%, and
- 30 < canopy closure ≤ 70%.

Treatment Implications

Not available.

White-breasted Nuthatch (*Sitta carolinensis*)

Goal Description

The user wishes to create or enhance habitat for the white-breasted nuthatch.

Species Information—Species information includes the following:

Range: Breeding—Southern Quebec, west to southern British Columbia, south to Florida and Mexico. Winter—same as breeding range.

Relative abundance in New England: Common.

Habitat: Breeding—mixed or deciduous woodlands with large trees, orchards, and villages. Winter—birds tend to remain in breeding areas.

Special habitat requirements: Natural cavities for nesting; trees with minimum dbh of 30.5 cm.

Nest site: Cavity in a live, dead, or dying tree at almost any height above the ground; seems to prefer rotted-out knot holes or similar natural openings to old woodpecker holes; rarely, if ever, excavates own cavity; much competition for natural cavities occurs between white-breasted nuthatches and gray and red squirrels.

Territory size: Winter feeding territories ranged from 10.1 to 12.1 ha per pair in woodlands and about 20.2 ha per pair in semi-wooded country.

Sample densities: Sample includes 1 pair per 9.6 ha in New York; 6 pairs per 40 ha in oak-yellow-poplar forest in Maryland; 5 pairs per 40 ha in semi-open floodplain forest (sycamore, ash, elm) in Maryland.

Foraging: Major foods—insects, seeds, fruits, and mast; the main summer diet consists of gypsy moth larvae and tent caterpillars, beetles, spiders, and ants. Substrates—trunks and larger branches of trees, and bark crevices. Techniques—gleaning and probing. Preferred feeding habitat—often uses feeding stations, especially in winter.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Live cavity tree = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Live cavity tree = present.

Treatment Implications

Not available.

White-eyed Vireo (*Vireo griseus*)

Goal Description

The user wishes to create or enhance habitat for the white-eyed vireo.

Species Information—Species information includes the following:

Range: Breeding—southern New England and southeastern New York, west to Wisconsin and Nebraska, south to Mexico and the Gulf Coast. Winter—South Carolina, west to southern Texas.

Relative abundance in New England: Locally common (Long Island) to rare (Maine).

Habitat: Breeding—dense shrubby lowlands, briar patches, deciduous forest undergrowth and forest edges, hedgerows, old fields, and low swampy areas; less often on drier hillsides and along rural roads; the white-eyed vireo prefers close-growing stands of trees 2.4 to 7.6 m tall (either saplings or mature low trees such as *Crataegus spp*.).

Special habitat requirements: Low shrubby vegetation that provides foraging and nesting substrates.

Nest site: Suspended from the fork of a low branch, usually well hidden by surrounding vegetation; most often placed in a small sapling or shrub.

Territory size: Approximately 1.0 to 1.4 ha per male; territories may be as small as 0.13 ha per male; 2.6 and 2.2 ha in stream and woodland edge thickets in Kansas.

Sample densities: In Maryland, 40 territorial males per 40 ha in shrub swamp; 32 territorial males per 40 ha in second-growth river swamp; 28 territorial males per 40 ha in brushy abandoned farmland.

Foraging: Major foods—insects and wild fruits. Substrates—branches and twigs and leaf surfaces. Techniques—gleaning and hover-gleaning. Preferred feeding habitat—feeds mainly in the inner canopy of trees and shrubs.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%.

Treatment Implications

Not available.

White-throated Sparrow (*Zonotrichia albicollis*)

Goal Description

The user wishes to create or enhance habitat for the white-throated sparrow.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to northern Mackenzie, south to northern New England, Massachusetts (Berkshires), New York (Catskills), Pennsylvania (Poconos), Wisconsin, and Alberta; rarely to West Virginia. Winter—Central New England, south to Florida, Pennsylvania, and Missouri, south to the Gulf Coast and Mexico; rarely to southern Canada.

Relative abundance in New England: Common (Maine) to uncommon (Connecticut).

Habitat: Breeding—Edges of northern deciduous and coniferous forests, brushy clearings, open stunted tree growth of higher elevations, border of bogs, cut-over, and open second-growth woodlands.

Nest site: On or close to ground, in brush pile, under fallen limb, in grass hummock or mat of dead grasses or bracken fern; typically located at edge of a clearing and well concealed by ground vegetation.

Territory size: Size is 110 territories ranged in size from 0.2 to 1.1 ha, (average 0.3 ha) in Algonquin Provincial Park in Ontario.

Sample densities: Densities have been found to vary from no birds in bog and hardwood forest to 56 territorial males per 40 ha in balsam fir and white spruce.

Foraging: Major foods—insects, seeds of grasses and weeds, and wild fruits. Substrates—weeds and grasses, and leaf litter. Technique—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, or birch, and
- Size class = regeneration, sapling, or pole, and
- Ground layer percent cover > 75%, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%.

OR

- HAM forest type = northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, white pine/red oak/red maple, or white pine, or
- Size class = large sawtimber, and
- Ground layer percent cover > 75%, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%.

OR

- HAM forest type = northern red oak, and
- Size class = small sawtimber, and
- Ground layer percent cover > 75%, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%.

Treatment Implications

Not available.

White-winged Crossbill (*Loxia leucoptera*)

Goal Description

The user wishes to create or enhance habitat for the white-winged crossbill.

Species Information—Species information includes the following:

Range: Breeding—coniferous forests of Canada, south to northern New England, Minnesota, and British Columbia. Winter—irregularly south to North Carolina, Illinois, and northern Oregon.

Relative abundance in New England: Uncommon.

Habitat: Breeding—coniferous forests. Winter—Coniferous forests.

Special habitat requirements: Coniferous forests.

Nest site: Horizontal limb of spruce; nest heights vary considerably with some reported in low spruce shrubs and others at tops of 21 m trees; reportedly nests in pines and other conifers, though less frequently.

Foraging: Major foods—seeds of conifers, hardwood trees especially birch and alder; weed seeds, fruits, and small amounts of insects. Substrates—branches of evergreens, and clumps of needles. Techniques—extracting seeds from conifer cones.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Coniferous midstory cover > 25%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, or eastern hemlock, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coniferous midstory cover > 25%.

Treatment Implications

Not available.

Wild Turkey (*Meleagris gallopavo*)

Goal Description

The user wishes to create or enhance habitat for the wild turkey.

Species Information—Species information includes the following:

Range: Breeding—resident in parts of Vermont, New Hampshire, Maine, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Maryland, and West Virginia; largest numbers occur in southern New York and southward in the Appalachian highlands through Pennsylvania and West Virginia; range is expanding in New England where a population was recently reestablished via trapping and transplanting. Winter—same as breeding range.

Relative abundance in New England: Locally common to rare.

Habitat: Breeding—forests, woodland clearings mostly in hilly or mountainous regions where food is available, and open fields with trees nearby for roosting and cover; ideal habitat is a network of open, mixed forests and fields; the conifers provide roosting sites, and the hardwoods provide feeding areas. Winter—in woodlands, flocks prefer south slopes with mast producing hardwoods and abundant springs and seeps; in New England, turkeys readily use agricultural habitats such as cornfields, dairy farms, orchards, and pastures with abundant barberry or other fruiting shrubs.

Special habitat requirements: Mast-producing woodlands; large conifers or hardwoods for roosting, open woodlands, and abundant water.

Nest site: Turkeys lay their eggs in a simple depression on dry ground, usually in dead leaves; nests are usually under low, shrubby cover, near water, and next to a tree or stump; hens exhibit no forest-type preference, but often nest in cut-over areas.

Home range: Annual range includes 1.5 to 1.9 km^2, but seasonal ranges are smaller and often distinct from one another; home ranges are often restricted to 40 to 80 ha during the winter and nesting seasons; large movements often occur in early spring, late summer, and fall.

Sample densities: 3 birds per km^2 on forested refuge land in West Virginia; 6 to 8 birds per km^2 under ideal conditions.

Foraging: Major foods—acorns and beechnuts are staple foods; turkeys will eat the fruits and seeds of most trees and shrubs, also fruits, flowers, and leaves of herbaceous plants, tubers, roots, and insects. Substrates—leaf litter and plants. Techniques—scratching and pecking, gleaning, and grazing. Preferred feeding habitat—mast-producing woodlands during fall and winter; fields, pastures, and woodlands with rich, herbaceous ground cover during summer.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, or birch, and
- Size class = regeneration, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Seeps = present, and
- Ground layer percent cover > 75%, and
- 15 < canopy closure ≤ 70%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = northern hardwoods, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Seeps = present, and
- Ground layer percent cover > 75%, and

- 15 < canopy closure ≤ 70%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = bottomland hardwoods, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Seeps = present, and
- Ground layer percent cover > 75%, and
- 15 < canopy closure ≤ 70%, and
- Soft mast or hard mast = present.

Treatment Implications

Treatments may include the following:

- Maintaining a variety of conditions across the landscape;
- Maintaining areas with deciduous or mixed deciduous and coniferous forests with open understories, trees averaging 12 inches in dbh, and trees and shrubs that produce mast and fruit;
- Maintaining non-forested areas with herbaceous plants 1 to 2 ft tall; and
- Maintaining agricultural areas with corn or soybean crops.

Willow Flycatcher (*Empidonax traillii*)

Goal Description

The user wishes to create or enhance habitat for the willow flycatcher.

Species Information—Species information includes the following:

Range: Breeding—southern Maine, west to British Columbia, south to northern Virginia, central Arkansas and southern New Mexico. Winter—Central and South America.

Relative abundance in New England: Uncommon.

Habitat: Breeding—prefers open, newly clearcut areas, damp to dry brushy fields, woodland edges, hedgerows, roadsides, and orchards; frequents uplands and lowlands.

Special habitat requirements: Low trees and shrubs with clearings (edges).

Nest site: In a fork or saddled on a horizontal limb of a shrub, commonly willow, elder, viburnum, hawthorn, and others.

Territory size: Size is 0.3 to 1.2 ha (average 0.7 ha) for 73 territories in a dry marsh in Michigan; singing males of three separate populations had average territory sizes of 1.1, 1.3, and 1.8 ha.

Sample densities: Sample includes 10 to 11 pairs per km^2 in willow clump habitat in Illinois (8 to 9 birds per 40 ha).

Foraging: Major foods—flying insects. Substrate—air. Techniques—hawking and flight gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%.

Treatment Implications

Not available.

Wilson's Warbler (*Wilsonia pusilla*)

Goal Description

The user wishes to create or enhance habitat for the Wilson's warbler.

Species Information—Species information includes the following:

Range: Breeding—eastern Canada, south to central Maine, northern New Hampshire, northern Vermont and northern Minnesota. Winter—Mexico, south to Panama.

Relative abundance in New England: Uncommon.

Habitat: Breeding—swampy and brushy land, such as tamarack bogs or swampy runs, willow and alder swales; generally stays low, within 3.0 m of ground.

Nest site: On or sunken in the ground; usually among bushes, such as alders or smaller shrubs, or at the base of sapling; may nest in loose colonies in favorable habitat.

Territory size: In California, mean 0.57 ha, range 0.2 to 1.3 ha; mean 0.48 ha, range 0.3 to 1.0 ha.

Foraging: Major foods—flies, gnats, plant lice, small caterpillars, other larvae, small grasshoppers, and spiders. Substrates—twigs to 7.6 m above ground. Techniques—hopping and twig gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, balsam fir, spruce-fir, eastern hemlock, northern red oak, or white pine, and
- Size class = regeneration, and
- Deciduous shrub layer or ericaceous shrub layer or coniferous shrub layer > 0%.

Treatment Implications

Not available.

Winter Wren (*Troglodytes troglodytes*)

Goal Description

The user wishes to create or enhance habitat for the winter wren.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to southern Alaska, south in the mountains to northern Georgia and northern Colorado. Winter—southern New England, west to Colorado, and south to the Gulf States.

Relative abundance in New England: Common (Maine) to uncommon (Massachusetts).

Habitat: Breeding—usually in or near dense undergrowth of damp coniferous forests, in thickets near woodland streams, banks of marshy ditches, piles of slash, boreal bogs, and usually with a log from which to sing. Winter—dense undergrowth and especially in moist areas.

Special habitat requirements: Moist coniferous woodlands with low woody vegetation or low-lying cold bogs or swamps; birds have been noted in mixed and hardwood forests on north-facing slopes in the mountains of Virginia.

Nest site: In hollow at base of stump or tree, tangled roots of fallen trees, in cavities in manmade structures, old woodpecker holes.

Territory size: Approximately 0.4 to 2.8 ha in garden-woodland areas.

Foraging: Major food—insects. Substrate—ground. Technique—gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, balsam fir, spruce-fir, red spruce, or white pine, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer > 0%, and
- Coniferous shrub layer > 0%, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = bottomland hardwoods, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer > 0%, and
- Coniferous shrub layer > 0%, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = eastern hemlock, and
- Size class = regeneration, sapling, or pole, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer > 0%, and
- Coniferous shrub layer > 0%, and
- Live cavity tree or dead cavity tree = present,

Treatment Implications

Not available.

Wood Thrush (*Hylocichla mustelina*)

Goal Description

The user wishes to create or enhance habitat for the wood thrush.

Species Information—Species information includes the following:

Range: Breeding—Maine, west to South Dakota, south to Florida and Texas. Winter—Mexico and Central America.

Relative abundance in New England: Common.

Habitat: Breeding—mature lowland forests (mainly deciduous or mixed); shady, cool, mature upland forests, and often near a swamp, pond, stream, or lake; sometimes in residential areas; requires abundant undergrowth; absent from higher mountains of New England.

Special habitat requirements: Deciduous or mixed forest with tall trees and abundant sapling growth; cool, moist conditions; apparently requires a tree at least 12 m, possibly for song perches.

Nest site: In a fork or saddle on a horizontal limb of a sapling or tree (often elm or maple), or well hidden in dense shrubbery.

Territory size: 0.08 to 0.8 ha. 0.8 to 2.8 ha in forested habitat in central Illinois; 0.6 ha in woodland edge in Kansas.

Sample densities: In Maryland, 40 territorial males per 40 ha in virgin hardwood deciduous forest; 16 territorial males per 40 ha in shrub swamp; 11 territorial males per 40 ha in mature northern hardwoods forest; 10 territorial males per 40 ha in mixed oak forest; 4 territorial males per 40 ha in pine-oak forest.

Foraging: Major foods—insects and fruits. Substrates—leaf litter on ground and understory vegetation. Techniques—ground gleaning, scratching, and turning leaves over with bill.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, balsam fir, spruce-fir, red spruce, northern red oak, white pine/red oak/red maple, or white pine, and

- Size class = regeneration, and
- Shrub layer percent cover > 20%, and
- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration or uneven-age, and
- Shrub layer percent cover > 20%, and
- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%, and
- Canopy closure > 70%.

OR

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Shrub layer percent cover > 20%, and
- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%, and
- Canopy closure > 70%.

Treatment Implications

Treatments may include the following:

- Maintaining deciduous and mixed deciduous and coniferous forests;
- Maintaining a high degree of vertical diversity; and
- Maintaining at least 70% canopy closure.

Worm-eating Warbler (*Helmitheros vermivorus*)

Goal Description

The user wishes to create or enhance habitat for the worm-eating warbler.

Species Information—Species information includes the following:

Range: Breeding—from southern New England, western New York, northern Indiana, and southern Iowa, south to Virginia, northern Georgia, and southern Missouri. Winter—the Bahamas, the West Indies, and Central America; rarely north to Florida.

Relative abundance in New England: Locally common (Lower Hudson Valley) to rare (north shore of Long Island).

Habitat: Breeding—deep, damp woods, wooded ravines or hillsides often near a running stream and a dense understory; birds favor second-growth deciduous woods with young trees and a shrubbery understory.

Special habitat requirements: Dense undergrowth.

Nest site: On ground often at base of tree, rock, or log; on hillsides or banks of ravines.

Foraging: Major foods—mainly insects and takes few worms. Substrates—leaf litter of forest floor. Techniques—ground gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = regeneration, sapling, pole, small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

OR

- HAM forest type = northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, sapling, pole, or small sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer cover > 0%, and
- Deciduous midstory cover > 25%, and
- Canopy closure > 70%, and
- Percent cover of leaf litter ≥ 30%.

Treatment Implications

Not available.

Yellow Warbler (*Dendroica petechia*)

Goal Description

The user wishes to create or enhance habitat for the yellow warbler.

Species Information—Species information includes the following:

Range: Breeding—Canada and Alaska to northern South America. Winter—Central and South America.

Relative abundance in New England: Common.

Habitat: Breeding—farmlands, orchards, roadsides, and along streams and lakes.

Special habitat requirements: Scattered small trees or dense shrubbery.

Nest site: Securely placed in a fork or crotch of a shrub, sapling, or tree; often in stream-side thickets and shrubbery associated with suburban gardens; adaptable in choice of nest site.

Sample densities: 26 pairs per km^2 in favorable habitat in North Dakota; 63 territorial males per 40 ha in shrubby field with stream-bordered trees in Maryland; 5 territorial males per 40 ha in field and edge habitat in Maryland.

Foraging: Major foods—insects such as caterpillars of gypsy moth and brown-tail and tent caterpillars, cankerworms, beetles, weevils, plant lice, and grasshoppers; also takes spiders. Substrates—small tree limbs generally 1.2 to 12.2 m high. Techniques—branch hopping and gleaning and hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, and
- Ground layer percent cover > 75%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 15%.

Treatment Implications

Not available.

Yellow-bellied Sapsucker (*Sphyrapicus varius*)

Goal Description

The user wishes to create or enhance habitat for the yellow-bellied sapsucker.

Species Information—Species information includes the following:

Range: Breeding—Newfoundland, west to Alaska, south to the mountains of Massachusetts, Virginia, Georgia, Missouri, and New Mexico. Winter—southern New England, west to Kansas and southern British Columbia, south to Central America.

Relative abundance in New England: Uncommon (southeastern New York) to common (Maine).

Habitat: Breeding—mixed hardwood-conifer forests, especially near water and small clearings, woodlots, and occasionally in orchards. Winter—floodplain forest and mature ornamental conifers.

Special habitat requirements: Trees with a dbh of 25.4 cm or more are most suitable for nesting.

Nest site: Excavates a cavity in a dead or living tree with rotten heartwood; nests in a variety of trees but prefers aspen when available; favors trees infected with *Fomes*.

Territory size: Varies from immediate vicinity of nest to 137.2 m or more.

Home range: 2.1 ha and 2.2 ha for 2 pairs in mature second-growth forest in Ontario.

Sample densities: In winter, 12 birds per 40 ha in bottomland forest in Illinois.

Foraging: Major foods—inner bark of trees, sap, insects (excluding wood-boring larvae), fruits and berries. Substrates—smooth bark on trunks of small and large living trees and limbs of larger trees. Techniques—drilling, hawking, and probing.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Live cavity tree = present.

Treatment Implications

Not available.

Yellow-billed Cuckoo (*Coccyzus americanus*)

Goal Description

The user wishes to create or enhance habitat for the yellow-billed cuckoo.

Species Information—Species information includes the following:

Range: Breeding—New Brunswick, west to British Columbia, south to the Florida Keys, Gulf Coast, and Mexico. Winter—South America.

Habitat: Breeding—open woods, overgrown weedy fields, roadsides, abandoned orchards, streambanks with dense thickets, and brushy pastures with small trees and vines; seldom seen at high elevations.

Special habitat requirements: Low, dense, and shrubby vegetation.

Nest site: Prefers to nest in thick bushes overgrown with grape vines or in trees on horizontal limbs; nest is usually well concealed by surrounding foliage.

Sample densities: 8 territorial males per 40 ha in upland oak forest in Maryland; 6 territorial males per 40 ha in floodplain forest in Maryland; 4 territorial males per 40 ha in hedgerows, active and abandoned farmland in Maryland.

Foraging: Major foods—caterpillars (staple) and other insects; many kinds of fruits such as grapes, mulberries and elderberries; frequently consumes larvae of gypsy moth, tent caterpillar, and fall webworm. Substrates—upper and lower leaf surfaces. Technique—leaf gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and

- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- 15 < canopy closure ≤ 30%.

Treatment Implications

Not available.

Yellow-breasted Chat (*Icteria virens*)

Goal Description

The user wishes to create or enhance habitat for the yellow-breasted chat.

Species Information—Species information includes the following:

Range: Breeding—southern British Columbia east to southern Ontario, and Massachusetts, south to southeastern Texas, the Gulf States and northern Florida. Winter—Mexico and Central America to Panama; irregularly in small numbers to coastal sections of southeastern Massachusetts.

Relative abundance in New England: Local breeder from central Massachusetts south.

Habitat: Breeding—brushy pastures, thickets or briar patches, usually near water; clearings with young growth resulting from logging or burning; avoids high elevations. Winter—dense thickets.

Special habitat requirements: Dense shrubs and vines with scattered young trees, often near water.

Nest site: In a bush, small sapling or tangle of grapevines, catbrier, brambles, and occasionally on the ground.

Territory size: 0.5 to 1.0 ha per pair, though individuals may roam well into a neighboring territory.

Habitat: Grown-over abandoned fields in northern Virginia.

Sample densities: In Maryland, 36 territorial males per 40 ha in shrubby field with trees and stream; 28 territorial males per 40 ha in deciduous scrub (damp) with snags; 15 territorial males per 40 ha in dry deciduous scrub resulting from fire.

Foraging: Major foods—beetles, bugs, ants, wasps, weevils, mayflies, various caterpillars including tent caterpillars and currant-worms, raspberries, whortleberries, wild strawberries, blackberries, and wild grapes. Substrates—brush and saplings. Techniques—shrub stem and foliage gleaning.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, and
- Province (ignored) = Allegheny Plateau, and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%.

Treatment Implications

Not available.

Yellow-rumped Warbler (*Dendroica coronata*)

Goal Description

The user wishes to create or enhance habitat for the yellow-rumped warbler.

Species Information—Species information includes the following:

Range: Breeding—Alaska and Canada south to Massachusetts (Berkshires), Pennsylvania (Poconos), and New York (Catskills). Winter—central New England, south through the United States, Central America, Bermuda, Bahamas, and the Virgin Islands.

Relative abundance in New England: Common breeder at higher elevations.

Habitat: Breeding—coniferous woods (especially in spruce-fir) or in young coniferous growth near the edges of woods; sometimes in mixed woods. Winter—along the coast in any type of woodland, in thickets and gardens.

Special habitat requirements: Coniferous trees (summer), bayberry thickets (winter).

Nest site: Usually in a small coniferous tree, typically saddled on a branch of spruce, hemlock, or cedar; sometimes in a deciduous tree such as maple or birch.

Sample densities: 30 pairs per 40 ha on Loud's Island, Maine (83% red spruce and 14% white spruce); 39 pairs per 40 ha on Marsh Island, Maine (100% white spruce); 31 pairs per 40 ha on Harbor Island, Maine (100% white spruce).

Foraging: Major foods—insects in summer (plant lice, caterpillars, small grubs, ants, and leaf beetles); in winter, eggs and larvae of some insects, bayberries, berries of red cedar, woodbine, viburnums, honeysuckle, mountain ash, poison ivy, and so on. Substrates—trunks and branches from tops of trees to ground level, air. Techniques—trunk and branch gleaning and hawking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Coniferous midstory cover > 25%.

OR

- HAM forest type = northern hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Coniferous midstory cover> 25%.

Treatment Implications

Not available.

Yellow-throated Vireo (*Vireo flavifrons*)

Goal Description

The user wishes to create or enhance habitat for the yellow-throated vireo.

Species Information—Species information includes the following:

Range: Breeding—Maine, west to Saskatchewan, south to Florida and Texas. Winter—Southern Mexico to South America.

Relative abundance in New England: Rare (Maine).

Habitat: Breeding—tall deciduous trees in woodlands with partially opened canopy, seldom in dense forests, rarely in conifers; frequents roadsides, borders of streams, orchards and woodland borders, swampy woods.

Special habitat requirements: Tall deciduous trees.

Nest site: Suspended between a fork formed by slender branches of a horizontal limb, typically over 6.1 m above ground.

Territory size: About 4.0 ha.

Sample densities: In Maryland, 19 territorial males per 40 ha in virgin hardwood deciduous forest; 8 territorial males per 40 ha in second growth river swamp; 7 territorial males per 40 ha in mixed oak forest; 3 territorial males per 40 ha in well-drained floodplain forest.

Foraging: Major foods—insects, especially adult and larval moths. Substrates—twig and branch surfaces, less often on leaf surfaces. Techniques—gleaning; typically feeds slowly and deliberately, occasionally hovering or hawking. Preferred feeding habitat—top of canopy (upper half), periphery, and central portions.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- 30 < canopy closure ≤ 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- 30 < canopy closure ≤ 70%.

Treatment Implications

Not available.

Mammals

Beaver (*Castor canadensis*)

Goal Description

The user wishes to create or enhance habitat for beaver.

Species Information—Species information includes the following:

Range: Most of North America with the exception of the high Arctic, parts of the southwestern United States, Florida, and Mexico.

Relative abundance in New England: Common.

Habitat: Small to large slowly flowing brooks, streams, or rivers that are usually, but not necessarily, bordered by woodland.

Special habitat requirements: Wetlands that provide an adequate food supply and sufficient water depths.

Home range: Beavers have been known to range in excess of 137 m from water in search of food but generally remain much closer to the lodge.

Food habits: Mainly a nocturnal feeder; consumes bark of deciduous trees especially aspen, balsam poplar, alder, willow, birch, and maple; also takes herbaceous vegetation especially aquatics, and some grasses; caches food under ice for winter use.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, northern red oak, or white pine/red oak/red maple, and
- Permanent ponds or streams = present.

Treatment Implications

Treatments may include the following:

- Maintaining seedling through pole-sized trees,
- Maintaining deciduous trees, and
- Maintaining forests near water.

Big Brown Bat (*Eptesicus fuscus*)

Goal Description

The user wishes to create or enhance habitat for big brown bat.

Species Information—Species information includes the following:

Range: Southern Canada, west to Alaska, south to northern Florida and South America.

Relative abundance in New England: Common.

Habitat: Buildings, bridges, caves, tunnels, and hollow trees in wooded areas; avoids hot attics.

Special habitat requirements: Seems to require cold, dry areas of caves or buildings for hibernation.

Home range: Probably travels less than 48 km from birthplace and often uses the same site for summer roosting and hibernation.

Food Habits: Beetles, wasps, flies, bugs, and other flying insects; beetles accounted for the highest percentage of diet in Indiana; individuals may use the same feeding ground each night; general in foraging habitat.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, small sawtimber, or large sawtimber, and
- Live cavity tree = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Live cavity tree = present.

Treatment Implications

Not available.

Black Bear (*Ursus americanus*)

Goal Description

The user wishes to create or enhance habitat for black bear.

Species Information—Species information includes the following:

Range: Throughout Canada except the northern coast; in the United States, occurs in the Sierras, Idaho, and Montana, south through the Rockies into Mexico, northern Great Lakes area, Ozarks, Gulf Coast, Florida, and New England, south through the Appalachians to northern Georgia.

Relative abundance in New England: Common in north to uncommon farther south; increasingly reported from northwestern New Jersey.

Habitat: Primarily in fairly remote forests and swamps; prefers mixed deciduous-coniferous woodlands with a thick understory; requires abundant sources of hard or soft mast within its habitat.

Special habitat requirements: Den sites located under fallen trees, in hollow logs, rock ledges, slash pile, or other protected areas.

Home range: Home range size varies with many factors and is presently unknown; there is probably a greater seasonal range in the male black bear than the female; most widely accepted range is a 24 km average radius for adult males and a somewhat smaller radius for females.

Food habits: Plant material is the major food; forbs and grasses eaten in spring, soft mast (fruit) in summer, and hard and soft mass in fall; omnivorous feeder consuming insects, especially grubs and ants under the bark of rotten logs and stumps, mice, frogs, fish, acorns, and beechnuts, apples and numerous berries; also takes carrion and garbage.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Province (ignored) = Allegheny Plateau, or valley and ridge, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Soft mast or hard mast = present.

Treatment Implications

Treatments may include the following:

- Maintaining a variety of forest conditions across the landscape,
- Maintaining trees and shrubs that produce hard and soft mast, and
- Maintaining dead and down material.

Bobcat (*Felis rufus*)

Goal Description

The user wishes to create or enhance habitat for bobcat.

Species Information—Species information includes the following:

Range: Southern Canada, south throughout the west half of the United States and through the eastern uplands and mountains; also occurs along the Gulf Coast and in Florida; reintroduced to northern New Jersey.

Relative abundance in New England: Common to uncommon.

Habitat: Mixed deciduous-coniferous and hardwood forests and brushy and rocky woodlands broken by fields, old roads, and farmland; frequently found in cedar swamps and spruce thickets; favors areas with thick undergrowth; softwood cover preferred in winter.

Special habitat requirements: Rocky ledges critical in Massachusetts; prefers to den in rock crevices, under windfalls, or in hollow logs; the den is usually lined with dried grasses, leaves, and moss.

Home range: 3.2 to 8 linear km for nightly travel in Massachusetts; 10.5 to 12.5 ha in Massachusetts; in Maine, mean annual home range was 23 km^2, winter ranges were 30% larger than summer ranges; in the Catskills, home range was approximately 36 km^2 for males and 31.0 km^2 for females; Adirondack ranges were estimated to be 325 km^2 for males and 86 km^2 for females; ranges farther to find mates or follow prey; in Minnesota, bobcats traveled 4.8 to 11.2 km while hunting.

Food habits: Small mammals, especially snowshoe hare, cottontails, squirrels, mice, and birds and their eggs; deer is a principal winter diet component in New York; carrion (untainted), snakes, fish, crustaceans, insects, and some vegetation are also eaten; most prey is taken by stalking.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, or New England lowlands, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer or coniferous shrub layer cover > 0%, and
- Canopy closure > 30%.

Treatment Implications

Not available.

Coyote (*Canis latrans*)

Goal Description

The user wishes to create or enhance habitat for coyote.

Species Information—Species information includes the following:

Range: New England (except Rhode Island), New York, northern Pennsylvania, northern Ohio, south to Texas and west to California.

Relative abundance in New England: Uncommon to common.

Habitat: Edges of second growth forests, open brushy fields, fallow agricultural land, and forest openings created by fire or logging. Winter—coyotes may concentrate in low-lying areas with abundant snowshoe hares and deer.

Special habitat requirements: Open or semi-open country for hunting, secluded den sites.

Home range: Size may exceed an area 8 km in diameter depending on food supply and time of year; range sizes of radio-tracked individuals were greater for males (average 68 km^2) than females (16 km^2) in Minnesota; pack animals defend well defined territories pairs and solitary individuals do not.

Sample densities: The winter density of coyotes on an island in Lake Michigan was estimated at 1 animal per 5.2 km^2.

Food habits: Opportunistic feeders consuming mainly carrion, small live vertebrates, invertebrates, and vegetation; winter food in the Northeast in mainly snowshoe hare and carrion of deer.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Loose soils or caves = present.

Treatment Implications

Not available.

Deer Mouse (*Peromyscus maniculatus*)

Goal Description

The user wishes to create or enhance habitat for deer mouse.

Species Information—Species information includes the following:

Range: Most of North America except northern Canada, western Mexico, the se. United States and the Atlantic Coastal Plain.

Relative abundance in New England: Common.

Habitat: Mainly occurs in interiors or along edges of coniferous or mixed forests, along field borders, stone walls, and in out-buildings near areas with small trees and dense ground cover; uses recent forest clearcuts.

Home range: Average 0.9 ha for adult males and 0.6 ha for adult females in virgin hardwood forest in Michigan; 0.04 to 0.13 ha for adult males and 0.05 to 0.10 for adult females.

Sample densities: Density normally ranges from a low of 1 mouse per 0.8 ha in spring to a high of 22 mice per 0.8 ha in autumn.

Food habits: Nuts, seeds, grains, fruits, and mushrooms; also eats small invertebrates such as worms, snails, insect larvae, and occasionally carrion; caches food in fall for winter use.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = Allegheny Plateau, or valley and ridge, and
- Loose soils or rock piles = present, and
- Ground layer percent cover > 75%, and
- 15 < canopy closure ≤ 30%, and
- Hard mast = present.

Treatment Implications

Not available.

Eastern Chipmunk (*Tamias striatus*)

Goal Description

The user wishes to create or enhance habitat for eastern chipmunk.

Species Information—Species information includes the following:

Range: Quebec, west to Manitoba south through most of eastern United States to Louisiana and northwestern Florida; absent from most of Coastal Plain.

Relative abundance in New England: Common.

Habitat: Edges or interiors of deciduous woodlands with abundant cover of undergrowth, old logs, and stone walls; semi-open brushlands with ample cover.

Special habitat requirements: Tree or shrub cover and elevated perches.

Territory: A female defended a 45.5 m radius surrounding the living quarters in oak-hickory woodland in Michigan; individuals maintain dominance in a core area that covers about 20% of home range.

Home range: Less than 91 m in diameter; 0.2 to 0.4 ha in northern hardwoods in the Adirondacks of New York.

Sample densities: Sample includes 5 individuals per ha at onset of breeding season increasing to 10 individuals or more per ha at the end of the breeding season; up to 74 individuals per ha in good habitats; varies geographically and temporally from 0.3 to 37.6 per ha.

Food habits: Many kinds of seeds, fruits, nuts, bulbs, insects, meat, and eggs; feeds during daylight hours.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, white pine / red oak / red maple, or white pine, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer > 0%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = red spruce, or eastern hemlock, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer > 0%, and
- Soft mast or hard mast = present.

Treatment Implications

Treatments may include the following:

- Maintaining deciduous forests or mixed deciduous and coniferous forests,
- Maintaining trees that produce mast,
- Maintaining dense understories of small trees and other woody plants, and
- Maintaining dead and down material.

Eastern Fox Squirrel (*Sciurus niger vulpinus*)

Goal Description

The user wishes to create or enhance habitat for Eastern fox squirrel.

Species Information—Species information includes the following:

Range: Occurs in the Valley and Ridge, Blue Ridge, Piedmont Plateau, and Coastal Plain Provinces of Pennsylvania, south to Florida west to mid-Texas and north to North Dakota.

Relative abundance in New England: Does not occur in New England.

Habitat: Deciduous or mixed forests; nests in tree cavities or builds a leaf and twig nest in crotch or branches.

Special habitat requirements: Deciduous shrubs; live trees with cavities; moderately sparse (16 to 30%) overstory cover; and soft and hard mast.

Home range: Range is 10 to 40 acres (4 to 16 hectares).

Food habits: Nuts, acorns, seeds, fungi, bird eggs, and cambium beneath bark.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, northern red oak, or white pine/red oak/red maple, and
- Province (ignored) = Ridge and Valley, Blue Ridge, Piedmont Plateau, or Coastal Plain, and
- Deciduous shrub layer > 0%, and
- Live cavity tree = present, and
- 15 < canopy closure ≤ 30%, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Eastern Mole (*Scalopus aquaticus*)

Goal Description

The user wishes to create or enhance habitat for eastern mole.

Species Information—Species information includes the following:

Range: Massachusetts, west to Wyoming, south to central Texas and the Gulf of Mexico.

Relative abundance in New England: Locally common.

Habitat: Pastures, meadows, lawns, and less often in open woodland, in loamy or sandy soils that permit easy digging; often in moist (not wet) bottomlands where earthworms are plentiful.

Special habitat requirements: Soft moist soils containing earthworms.

Home range: Average area 0.74 ha for 7 moles in Kentucky, 4 males averaged 1.09 ha; 3 females averaged 0.28 ha.

Sample densities: Active throughout the year during all hours of day and night except early morning and early evening; digs tunnels just below surface or in dry or cold weather excavates deeper burrows 10 inches or more deep; spends most of life below ground; young are independent when about 1 month old; solitary except during breeding season.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, or white pine/red oak/red maple, and
- Size class = regeneration or large sawtimber, and
- Province (ignored) = Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain, and
- Loose soils = present.

OR

- HAM forest type = bottomland hardwoods, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- Province (ignored) = Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain, and
- Loose soils = present.

OR

- HAM forest type = northern red oak, and
- Size class = large sawtimber, and
- Province (ignored) = Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain, and
- Loose soils = present.

Treatment Implications

Not available.

Eastern Pipistrelle (*Pipistrellus subflavus*)

Goal Description

The user wishes to create or enhance habitat for eastern pipistrelle.

Species Information—Species information includes the following:

Range: Southeastern Canada, west to Minnesota, south to eastern Mexico and Central America; absent from northern New England, Michigan, and southern Florida.

Relative abundance in New England: Uncommon to rare.

Habitat: Open woods near water, crevices in cliffs, buildings, and caves; avoids deep woods; commonly roosts in trees during summer days.

Special habitat requirements: Warm, draft free, and damp sites for hibernation.

Home range: Believed to feed within a radius extending at least 8 km from roosting site.

Food habits: Usually solitary feeder; prefers to feed over rivers, pastures (if large trees are nearby) and high in bordering trees in search of flies, beetles, ants, bugs, moths, and wasps; leaf hoppers are important food.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- 30 < canopy closure ≤ 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = regeneration, small sawtimber, large sawtimber, or uneven-age, and
- 30 < canopy closure ≤ 70%.

Treatment Implications

Not available.

Eastern Woodrat (*Neotoma magister*)

Goal Description

The user wishes to create or enhance habitat for eastern woodrat.

Species Information—Species information includes the following:

Range: Allegheny Plateau, Valley and Ridge, and Blue Ridge Provinces of Pennsylvania; does not occur in New England.

Relative abundance in New England: Considered rare in Pennsylvania.

Habitat: Dry and rocky forests.

Special habitat requirements: Rock crevices leading below frost line or caves; moderate ground cover; deciduous and ericaceous shrubs; moderate overstory cover; lots of surface rocks; and hard and soft mast.

Home range: About 1 acre (0.4 ha).

Food habits: Nuts, berries, seeds, etc.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, or Blue Ridge, and
- Rock crevices = present, and
- 30 < ground layer percent cover ≤ 75%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- 30 < canopy closure ≤ 70%, and
- Percent cover rock > 25%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = northern red oak, or white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, or Blue Ridge, and
- Rock crevices = present, and
- 30 < ground layer percent cover ≤ 75%, and
- Deciduous shrub layer or ericaceous shrub layer cover > 0%, and
- 30 < canopy closure ≤ 70%, and

- Percent cover rock > 25%, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Ermine (*Mustela erminea*)

Goal Description

The user wishes to create or enhance habitat for ermine.

Species Information—Species information includes the following:

Range: Throughout Alaska and most of Canada, south in the United States to southern Pennsylvania and western Maryland, the Great Lakes region and the northwestern quarter of the country.

Relative abundance in New England: Common to uncommon.

Habitat: Wooded or open country with thickets, rock piles or other heavy cover; often close to watercourses.

Special habitat requirements: Small rodents and dense brushy cover.

Home range: Approximately 12.1 to 16.2 ha under normal conditions but may extend for 3.2 to 4.8 km per night during periods of food shortage.

Sample densities: May reach 8 individuals per km^2 in favorable habitat.

Food habits: Mice (staple), chipmunks, moles and shrews, occasionally birds and insects, and rarely snakes, frogs, or fish.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Deciduous shrub layer, coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Live cavity tree or dead cavity tree = present, and

- Canopy closure ≤ 15% or canopy closure > 70%, and
- Percent cover rock > 25%.

Treatment Implications

Not available.

Gray Fox (*Urocyon cinereoargenteus*)

Goal Description

The user wishes to create or enhance habitat for gray fox.

Species Information—Species information includes the following:

Range: Throughout the United States except Idaho, Montana, Wyoming, most of Washington, and the western plains, south to Texas; recently extended north to southeastern Canada.

Relative abundance in New England: Common to uncommon; presently is reoccupying range in New England.

Habitat: Dense northern hardwoods or mixed forests; may inhabit thickets and swamps; prefers a mixture of fields and woods.

Special habitat requirements: Den sites such as hollow logs, tree cavities, rock crevices, or cavities beneath deserted buildings, rarely in ground burrows.

Home range: Varies with food supply, disturbances, denning, and season; range varies from 1.6 km wide during denning to 8 km in the fall; home ranges from 75 to 185 ha.

Food habits: Crepuscular and nocturnal; chiefly small mammals, particularly cottontails, but includes birds, reptiles, and amphibians and their eggs; acorns, insects, fruits, and carrion are also eaten.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, northern red oak, or white pine/red oak/red maple, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and

- Live cavity tree = present, and
- Canopy closure > 70%, and
- Soft mast or hard mast = present.

Treatment Implications

Treatments may include the following:

- Maintaining a variety of deciduous forests intermixed with areas not dominated by trees across the landscape,
- Maintaining trees and shrubs that produce mast and fruit,
- Maintaining cavity trees at least 24 inches in dbh, and
- Maintaining dead and down material.

Gray Squirrel (*Sciurus carolinensis*)

Goal Description

The user wishes to create or enhance habitat for gray squirrel.

Species Information—Species information includes the following:

Range: Southern Quebec to Manitoba, south to Texas and Florida.

Relative abundance in New England: Common to abundant.

Habitat: Deciduous and mixed forests, especially those with trees that produce mast; river bottomland, woodlots in town, and city parks.

Special habitat requirements: Oaks, tall trees for dens or leaf nests (nests are usually 7.6 m or more above ground).

Home range: 0.8 to 2.8 ha; the average minimum home range of 43 individuals in mature oak-hickory woods in West Virginia was 0.50 ha; 0.49 ha was the average range of 55 squirrels in mature to over-mature oak-hickory stand in West Virginia; 0.57 ha in mature oak-hickory, beech, and popular woodlots in Maryland.

Food habits: Diurnal feeder; consumes nuts, buds, seeds and grains, fungi, fruits, birds' eggs, inner bark of trees; commonly caches food for future use; will eat insects and then pupae in spring and summer when preferred foods are scarce.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Live cavity tree = present, and
- Canopy closure > 70%, and
- Soft mast or hard mast = present.

OR

- HAM forest type = bottomland hardwoods, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = small sawtimber, or large sawtimber, and
- Live cavity tree = present, and
- Canopy closure > 70%, and
- Soft mast or hard mast = present.

Treatment Implications

Treatments may include the following:

- Maintaining deciduous forest conditions,
- Maintaining trees that produce mast and fruit, and
- Maintaining 2 to 4 cavity trees on every 5 to 10 acres.

Hairy-tailed Mole (*Parascalops breweri*)

Goal Description

The user wishes to create or enhance habitat for hairy-tailed mole.

Species Information—Species information includes the following:

Range: New Brunswick and southeastern Quebec, west to southeastern Ontario, south through eastern Ohio and western North Carolina (Appalachian Mountains).

Relative abundance in New England: Locally common.

Habitat: Open woods and meadows with light and sandy loam; prefers areas with vegetative cover and sufficient moisture; avoids heavy wet soils.

Special habitat requirements: Loose moist well drained soil.

Home range: About 0.1 ha.

Sample densities: An average density of 3 moles per ha on 11 ha and a maximum density of 27 individuals per ha has been reported in various habitats in New Hampshire. 25 to 30 moles per ha have been reported in maple-beech-hemlock woods in New York.

Food habits: Earthworms, insects (adults, larvae, pupae), millipedes, centipedes, snails, slugs, and sowbugs; forages on forest floor at night.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Loose soils = present, and
- Ground layer percent cover > 75%.

Treatment Implications

Not available.

Hoary Bat (*Lasiurus cinereus*)

Goal Description

The user wishes to create or enhance habitat for hoary bat.

Species Information—Species information includes the following:

Range: Southern Canada, south to central Florida and South America.

Relative abundance in New England: Rare.

Habitat: Wooded areas where it roosts 3 to 4.5 m above ground in trees; prefers coniferous forest but also uses deciduous woods and woodland edges, hedgerows and trees in city parks.

Special habitat requirements: Forest edge.

Home range: Feeding range may extend 1.6 km or more from roosting site.

Food habits: Forages for insects over lakes and forest clearings; out of 139 hoary bats examined in New Mexico, 136 contained moths, up to 25 individuals per bat; has been seen attacking pipistrelles in New York.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, white pine/red oak/red maple, or white pine, and
- Canopy closure > 70%.

OR

- Size class = regeneration.

Treatment Implications

Not available.

Indiana Myotis (*Myotis sodalis*)

Goal Description

The user wishes to create or enhance habitat for Indiana myotis.

Species Information—Species information includes the following:

Range: Eastern New York and probably southern Vermont and western Massachusetts.

Relative abundance in New England: Rare and endangered.

Habitat: Favors limestone caves with pools of water; solitary females or small maternity colonies bear young in hollow trees or under loose bark; cannot tolerate high temperatures of attics.

Special habitat requirements: Caves for hibernation that have cool, stable temperatures of 40 to 46 °F throughout the winter; trees for nursery colonies.

Home range: Unknown.

Food habits: Forages in the foliage of crowns of trees 2 to 30 m tall along the shores of rivers and lakes and over floodplains; four stomachs examined in Indiana contained ichneumons, leafhoppers, beetles, and unidentified wasps.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, small sawtimber, or large sawtimber, and
- Province (ignored) = Ridge and Valley, and
- Live cavity tree = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Province (ignored) = Ridge and Valley, and
- Live cavity tree = present.

Treatment Implications

Not available.

Keen's Myotis (*Myotis keenii*)

Goal Description

The user wishes to create or enhance habitat for Keen's myotis.

Species Information—Species information includes the following:

Range: Newfoundland and Nova Scotia, west to Saskatchewan, south to Wyoming and northern Florida.

Relative abundance in New England: Common to uncommon.

Habitat: Females seek attics, barns, and tree cavities for small nursery colonies; both sexes roost singly or in small colonies in crevices under loose tree bark, in cliff walls, or in caves.

Special habitat requirements: For hibernation, Keen's myotis seeks caves or mine shafts with temperatures near 40 °F, high relative humidity, and calm air.

Home range: Unknown.

Food habits: Little is known, probably similar to little brown myotis; forages over ponds and clearings and high along the forest edge; stomach of three individuals in Indiana contained assassin bugs, moths, butterflies, flies, leaf hoppers, and other unidentified insects.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, small sawtimber, or large sawtimber, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Piedmont Plateau, or Coastal Plain, and
- Live cavity tree or dead cavity tree = present.

OR

- HAM forest type = northern hardwoods, or
- Size class = uneven-age, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Piedmont Plateau, or Coastal Plain, and
- Dead cavity tree = present.

OR

- Size class = uneven-age, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Piedmont Plateau, or Coastal Plain, and
- Live cavity tree = present.

Treatment Implications

Not available.

Least Weasel (*Mustela rixosa*)

Goal Description

The user wishes to create or enhance habitat for least weasel.

Species Information—Species information includes the following:

Range: Occurs in the Central Lowlands, Allegheny Plateau, and Valley and Ridge Provinces of Pennsylvania and along Appalachian region to North Carolina/Kentucky; west to central Nebraska and North Dakota; most of Canada and Alaska.

Relative abundance in New England: Does not occur in New England.

Habitat: Deciduous or mixed forests also meadows and fields; mostly nocturnal.

Special habitat requirements: Soils that can be burrowed into easily, rock piles, dead and down logs, and moderate forest litter.

Home range: Range is 2 acres (0.8 hectares).

Food habits: Mostly mice.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = central lowlands, Allegheny Plateau, or Ridge and Valley, and
- Loose soils or rock piles = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Little Brown Myotis (*Myotis lucifugus*)

Goal Description

The user wishes to create or enhance habitat for little brown myotis.

Species Information—Species information includes the following:

Range: Labrador west. to southern Alaska south to Georgia (in the Appalachians) Arkansas and southern California.

Relative abundance in New England: Common.

Habitat: Breeds in caves in fall; females seek attics and barns in spring for maternity colonies. Roosting—caves, quarries, mine tunnels, hollow trees, and buildings. Winter—caves with constant 40 °F temperature and 80% relative humidity.

Special habitat requirements: Females seek dark, warm sites for maternity colonies; males seek cooler daytime roosts, frequently in valleys near streams and marshes.

Home range: Unknown.

Sample densities: Summer—average 10 bats per km^2 over an 22,274 km^2 area served by a cave in southern Vermont. Winter—in caves in southern Vermont, 300,000 plus or minus 30,000.

Food habits: Congregate over water to drink and hawk flying insects, especially midges and mosquitoes, but also beetles, moths, and caddisflies.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, small sawtimber, or large sawtimber, and
- Live cavity tree = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Live cavity tree = present.

Treatment Implications

Not available.

Long-tailed Shrew (*Sorex dispar*)

Goal Description

The user wishes to create or enhance habitat for long-tailed shrew.

Species Information—Species information includes the following:

Range: Central and western Maine, south in the Appalachians to North Carolina.

Relative abundance in New England: Undetermined, possibly rare.

Habitat: Cold, damp coniferous forests, typically near moss-covered rocks and logs, which provide shady protective crevices, or wooded talus slopes; also found in deciduous and mixed forest; 5 individuals were found in a 1-year-old red spruce clearcut in West Virginia; others have been taken in road construction rubble.

Special habitat requirements: Rocky, wooded sites.

Home range: Unknown.

Sample densities: Sample includes 7 individuals were trapped on 0.4 ha of talus in Pennsylvania.

Food habits: Mainly insectivorous; also eats centipedes and spiders.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = birch, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, New England lowlands, or Piedmont Plateau, and
- Rock crevices = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock > 25%.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, New England lowlands, or Piedmont Plateau, and
- Rock crevices = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock > 25%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and

- Province (ignored) = Allegheny Plateau, Ridge and Valley, New England lowlands, or Piedmont Plateau, and
- Rock crevices = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover rock > 25%.

Treatment Implications

Not available.

Long-tailed Weasel (*Mustela frenata*)

Goal Description

The user wishes to create or enhance habitat for long-tailed weasel.

Species Information—Species information includes the following:

Range: Southern Canada to South America; not found in the southwestern deserts of the United States, northwestern Mexico or the Baja Peninsula.

Relative abundance in New England: Common to uncommon.

Habitat: Open woods and woodland edges, grasslands, river bottomlands, and fencerows; found in elevations from sea level to the alpine tundra zone; prefers to be near water.

Special habitat requirements: Uses previously excavated burrows or natural holes or crevices for dens.

Home range: Size varies with food availability, cover type, and season; studies in Wisconsin showed ranges of 12.1 to 16.2 ha and in Missouri, 162 ha; about 121.5 ha in mixed agricultural-wooded-marsh habitat in southern Michigan; average cruising radius was 0.5 km from den, and the average daily distance traveled by 1 large male was 3.2 km.

Food habits: Primarily small mammals including voles, mice, rabbits, shrews; some birds, and especially ground nesting species; a few insects and an occasional snake; small prey is eaten entirely; may climb trees to catch prey.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Size class = regeneration, sapling, or pole, and
- Rock piles or rock crevices = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Live cavity tree = present, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Maryland Shrew (*Sorex fontinalis*)

Goal Description

The user wishes to create or enhance habitat for Maryland shrew.

Species Information—Species information includes the following:

Range: Occurs in the Valley and Ridge, Blue Ridge, New England, Piedmont Plateau, and Coast Plain Provinces of Pennsylvania.

Relative abundance in New England: Does not occur in New England.

Habitat: Deciduous or mixed forests.

Special habitat requirements: Dead and down logs, and dense shrub cover.

Home range: Unreported.

Sample densities: Unreported.

Food habits: Unreported.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain, and

- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Shrub layer percent cover > 50%.

Treatment Implications

Not available.

Masked Shrew (*Sorex cinereus*)

Goal Description

The user wishes to create or enhance habitat for masked shrew.

Species Information—Species information includes the following:

Range: Throughout Canada and Alaska, south to North Carolina, New Mexico (mountains), and central Washington.

Relative abundance in New England: Common to uncommon.

Habitat: Damp deciduous and coniferous woodlands with grasses, rocks, logs, or stumps for cover; bogs and other moist areas; less often in open country with abundant moisture or in dry woods; found in clearcuts in West Virginia.

Special habitat requirements: High humidity (moist sites) and ground cover (especially leaves, rotten logs, herbaceous vegetation).

Home range: About 0.04 ha.

Sample densities: up to 22 individuals per ha have been reported in favorable habitats.

Food habits: Mainly insectivorous and carnivorous; also consumes worms, spiders, snails, slugs, and small amounts of vegetable matter; feeds among litter on forest floor.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Mink (*Mustela vison*)

Goal Description

The user wishes to create or enhance habitat for mink.

Species Information—Species information includes the following:

Range: Canada (except high Arctic), west through Alaska and south throughout the United States (except the southwestern deserts).

Relative abundance in New England: Common to uncommon.

Habitat: Streambanks, lakeshores, and marshes; favors forested wetlands with abundant cover such as thickets, rocks, or windfalls.

Special habitat requirements: Den sites inside hollow logs, natural cavities under tree roots or in burrows along stream, marsh, or lake edges.

Home range: Average range is 3.2 to 4.8 km in diameter for males along a river in Montana; 2 females had home ranges of 7.8 and 20.4 ha in similar river habitat; long-distance travel is common along waterways, and in winter mink may swim under the ice; home ranges often overlap between juveniles and adults.

Food habits: Aquatic and terrestrial prey; importance of prey items varies with season and habitat; small mammals, particularly muskrats, voles, rabbits, fish, frogs, salamanders, crayfish, clams, and insects; trails prey by scent and often caches food.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Streams = present, and
- Loose soils = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha).

Treatment Implications

Treatments may include the following:

- Maintaining a variety of conditions across the landscape,
- Maintaining forested areas with a high degree of vertical diversity along with dead and down material,
- Maintaining wetlands with shrubs and dead down woody debris, and
- Maintaining water bodies with nearby decaying logs.

New England Cottontail *(Sylvilagus transitionalis)*

Goal Description

The user wishes to create or enhance habitat for New England cottontail.

Species Information—Species information includes the following:

Range: Central and southern New England, south through eastern New York, Pennsylvania, northern New Jersey and the Appalachian Mountains (to slightly above 1,220 m) to Alabama.

Relative abundance in New England: Uncommon (southern New England) to rare (New Hampshire and Vermont).

Habitat: Brushy areas, open woodlands, swamps, and mountains; reported at beaches, saltmarshes, and open land; also in young woods associated with clearcuts and in hayfields or other grasslands ;dense cover and conifers are frequently components of habitats used by this species.

Special habitat requirements: Young woodlands with thick cover; seldom ventures far from dense cover.

Home range: 0.2 to 0.7 ha; average 1.2 ha for 17 females and 3.4 ha for 10 males in swamp and upland woods.

Food habits: Summer—grasses and herbs. Winter—seedlings, bark, twigs, buds (prefers maple and oak); coprophagic; food preference related to availability.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”
- If no stand in the management unit passes the stand level DFCs, then the management unit “fails.”

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = regeneration, sapling, or pole, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, or Piedmont Plateau, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer, coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 30%.

OR

- HAM forest type = spruce-fir, red spruce, eastern hemlock, or white pine, and
- Size class = regeneration, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, or Piedmont Plateau, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Shrub layer percent cover > 50%, and
- Deciduous shrub layer, coniferous shrub layer, or ericaceous shrub layer cover > 0%, and
- Canopy closure ≤ 30%.

Treatment Implications

Not available.

Northern Flying Squirrel (*Glaucomys sabrinus*)

Goal Description

The user wishes to create or enhance habitat for northern flying squirrel.

Species Information—Species information includes the following:

Range: Canada, west to Alaska, south in the Eastern United States to southern New England, and in the Appalachians to North Carolina; to the west the range extends south to North Dakota, Utah (Rocky Mountains), and northern California.

Relative abundance in New England: Common to uncommon.

Habitat: Forests of mixed mature conifers and deciduous trees; less often in purely hardwood forests; favors cool, heavily wooded areas above 305 m in elevation.

Special habitat requirements: Mature trees, cavities for winter dens; arboreal lichens for winter food.

Home range: Unknown.

Food habits: Nocturnal feeder; eats a variety of nuts, especially acorns; also takes seeds, catkins, fruits, buds, insects, mushrooms, birds' eggs, and nestlings; caches food in tree cavities.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Size class = small sawtimber, or large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, or Ridge and Valley, and
- Live cavity tree or dead cavity tree = present, and
- Soft mast or hard mast = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Province (ignored) = central lowlands, Allegheny Plateau, or Ridge and Valley, and
- Live cavity tree or dead cavity tree = present, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Northern Short-tailed Shrew (*Blarina brevicauda*)

Goal Description

The user wishes to create or enhance habitat for northern short-tailed shrew.

Species Information—Species information includes the following:

Range: Nova Scotia, west to Saskatchewan, south to East Texas and southern Florida.

Relative abundance in New England: Common.

Habitat: Both timbered and fairly open habitats, deciduous, mixed, and less often coniferous forests with moist loose humus; especially common along banks of streams and in meadows with tall rank grasses or sedges, brush piles and stone walls; avoids dry, warm sites; favored grass-sedge marsh and willow-alder shrub zone in Manitoba.

Special habitat requirements: Low vegetation, loose leaf litter, and high humidity.

Home range: 0.40 to 0.51 ha; 0.2 to 0.4 ha.

Sample densities: Densities of up to 119 per ha have been reported in good habitats.

Food habits: Mainly insects, plants, worms, sowbugs, snails, small vertebrates, centipedes and millipedes, and spiders.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = Allegheny Plateau, and
- Loose soils = present, and
- Shrub layer percent cover > 50%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Pygmy Shrew (*Sorex hoyi*)

Goal Description

The user wishes to create or enhance habitat for pygmy shrew.

Species Information—Species information includes the following:

Range: Gaspe Peninsula, west to southern Wisconsin, south in the Appalachians to northern Georgia.

Relative abundance in New England: Generally thought to be rare, but may be fairly common.

Habitat: Wet or mixed (wet-dry) habitat or less often in dry areas close to water; found in damp litter especially near rotten stumps and logs in wooded areas; prefers grassy openings in coniferous forest, but tolerates a variety of habitat conditions; in New Hampshire, this species was more abundant in swamp hardwood than coniferous stands.

Special habitat requirements: Moist leaf mold near water.

Home range: Unknown.

Food habits: Observed eating insects and flesh of small animals in captivity.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, white pine/red oak/red maple, or white pine, and
- Province (ignored) = Allegheny Plateau, or valley and ridge, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Porcupine (*Erethizon dorsatum*)

Goal Description

The user wishes to create or enhance habitat for porcupine.

Species Information—Species information includes the following:

Range: Nova Scotia and Quebec, west across boreal Canada to Alaska, south in the Appalachian to northern Virginia; in the Midwest to northern Minnesota and Wisconsin, and in the West to northwestern Texas, Arizona, and eastern California.

Relative abundance in New England: Common to uncommon.

Habitat: Mixed or coniferous forests especially northern hardwoods-hemlock, with adequate denning sites; not restricted to any plant or edaphic community.

Special habitat requirements: Den sites in rock ledges, trees, or other protected places.

Home ranges: Winter ranges averaged 2.4 ha in New Hampshire and 5.4 ha in the Adirondacks of New York; spring and summer ranges ranged from 13.0 to 14.6 ha in conifer-hardwood forest in Minnesota; varies with climate and habitat.

Food habits: Herbaceous and woody vegetation; eats large quantities of grasses, leaves, twigs, buds, mast, and bark; hemlock is a major winter food in the Northeast.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, or Blue Ridge, and
- Live cavity tree = present, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Raccoon (*Procyon lotor*)

Goal Description

The user wishes to create or enhance habitat for raccoon.

Species Information—Species information includes the following:

Range: Throughout most of southern Canada and the United States except for the deserts of the Southwest and higher elevations of the Rocky Mountains; also occurs from Mexico to Panama.

Relative abundance in New England: Common.

Habitat: Wooded areas interrupted by fields and water courses; not usually found in dense forests, commonly found in wetlands near human habitation; areas where water is available.

Special habitat requirements: A den in any protected areas, from a culvert to an abandoned woodchuck burrow; prefers hollow trees; dens are usually located in trees 3 m or more above the ground and are located near water.

Home range: Usually between 1 and 3 km in diameter; size varies with the individual, food availability, and weather; raccoons have traveled up to 246 km in 164 days.

Sample densities: Densities in New Jersey ranged from 1 raccoon per 1.8 ha in woodlands near suburban areas, to 1 raccoon per 18.9 ha in mixed forest and agricultural land.

Food habits: Omnivorous and opportunistic; animal matter is the major food in spring and early summer; fruits and seeds are eaten in summer, fall, and winter; crayfish, worms, insects, carrion, tender buds and shoots, grass, and garbage are typical foods.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Permanent ponds or streams = present, and
- Live cavity tree = present.

Treatment Implications

Not available.

Red Bat (*Lasiurus borealis*)

Goal Description

The user wishes to create or enhance habitat for red bat.

Species Information—Species information includes the following:

Range: Southern Canada from Nova Scotia, west to British Columbia south to Texas and northern Florida, also northern California south.

Relative abundance in New England: Uncommon to rare.

Habitat: Wooded areas where it roosts in trees 1.5 to 12.2 m above ground. Solitary except females with young. Rarely found in buildings or caves except during migration. In Maryland, bats favored deciduous woodlands. Greatest numbers were found along fence rows and forest edges, in roosting areas open only from below. Most active over water early in evening.

Special habitat requirements: Possibly trees for roosting.

Home range: Unknown, however, known to forage 546 to 910 m from day roosts.

Sample densities: 2.4 individuals per ha in Iowa.

Food habits: Feeds at height of tree foliage to ground, sometimes in pairs and often repeatedly follows the same route about 91 m in length; eats moths, beetles, bugs, flies, crickets, and other insects.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, northern red oak, white pine / red oak / red maple, or white pine, and
- Canopy closure > 70%.

Treatment Implications

Not available.

Red Squirrel (*Tamiasciurus hudsonicus*)

Goal Description

The user wishes to create or enhance habitat for red squirrel.

Species Information—Species information includes the following:

Range: Quebec west to Alaska, south in the Appalachians to Tennessee and in the Rockies to New Mexico.

Relative abundance in New England: Common to uncommon.

Habitat: Coniferous, mixed and occasionally deciduous forests, and rural woodlots.

Special habitat requirements: Woodlands with mature trees; conifers preferred.

Home range: About 0.4 ha when food is plentiful; 1.1 to 2.4 ha; less than 182 m in diameter; defends feeding and den sites.

Food habits: Diurnal and crepuscular; feeds on seeds of conifers, nuts, buds, sap, tender leaves, fruits, flowers, fungi, insects, birds' eggs, and the young of small vertebrates; caches food for winter use.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, bottomland hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, northern red oak, white pine/red oak/red maple, or white pine, and
- Live cavity tree = present, and
- Canopy closure > 70%, and
- Soft mast or hard mast = present.

Treatment Implications

Treatments may include the following:

- Maintaining coniferous forests,
- Maintaining trees that produce mast,
- Maintaining a high degree of vertical diversity, and
- Maintaining dead and down material and snags.

River Otter (*Lutra canadensis*)

Goal Description

The user wishes to create or enhance habitat for river otter.

Species Information—Species information includes the following:

Range: Throughout all but northernmost portions of Canada and Alaska and in all states of the United States; does not occur in deserts or treeless regions.

Relative abundance in New England: Uncommon, but probably more common than sightings and trappings would indicate.

Habitat: Borders of streams, lakes, or other wetlands in forested areas.

Special habitat requirements: Body of water such as stream, pond, lake, and rivers; suitable den sites.

Home range: Range is 24 or more linear km, 32 or 48 km for a pair or male but usually less than 1.6 km for females with young; territories maintained within home range.

Food habits: Aquatic animals especially fish, frogs, crayfish, salamanders, and turtles; also takes snakes, small birds, mammals, earthworms, and insects.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Province (ignored) = Allegheny Plateau, or valley and ridge, and
- Streams = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha).

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Province (ignored) = Allegheny Plateau, or valley and ridge, and
- Streams = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha).

Treatment Implications

Treatments may include the following:

- Maintaining a variety of water and dry land conditions across the landscape,
- Maintaining a permanent source of water such as lakes, rivers and streams,
- Maintaining a high water quality, and
- Maintaining woody debris and structure in and on the water, such as log jams.

Rock Vole (*Microtus chrotorrhinus*)

Goal Description

The user wishes to create or enhance habitat for rock vole.

Species Information—Species information includes the following:

Range: Cape Breton Island and eastern Quebec, west to northeastern Minnesota; the mountains of northern New England, south in the Appalachians to North Carolina.

Relative abundance in New England: Unknown, possibly rare, but may be locally common in appropriate habitat.

Habitat: Coniferous and mixed forests at higher elevations; favors cool, damp, moss-covered rocks and talus slopes in vicinity of streams; rock voles were captured in clearcuts in West Virginia, habitat not previously reported for this species; voles were found using edge between boulder field and mature forest in Minnesota; they have been taken at a new low elevation of 460 m in the Adirondacks.

Special habitat requirements: Cool, moist, and rocky woodlands with herbaceous ground cover and flowing water.

Home range: Unknown.

Food habits: Bunchberry, wavy-leafed thread moss, and blackberry seeds; may browse on blueberry bushes (twigs and leaves), mushrooms, and Clinton's lily, a captive subadult ate insects; seems to be diurnal with greatest feeding activity taking place in morning; less active in afternoon in northern Minnesota.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = northern hardwoods, balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Province (ignored) = Allegheny Plateau, and
- Streams = present, and
- Percent cover rock > 25%.

Treatment Implications

Not available.

Silver-haired Bat (*Lasionycteris noctivagans*)

Goal Description

The user wishes to create or enhance habitat for silver-haired bat.

Species Information—Species information includes the following:

Range: Southern Canada, west to southern Alaska, south to central California, central Texas and South Carolina.

Relative abundance in New England: Uncommon to rare.

Habitat: Forested areas near lakes or streams; roosts in foliage of trees, in tree cavities and under loose bark as well as in buildings or caves; frequently found in coniferous forest of mountains.

Special habitat requirements: Dead trees with loose bark or cavities for summer roosting sites, water courses.

Home range: Unknown.

Food habits: Feeds among trees and over ponds and streams often less than 20 feet above surface; may prefer emerging aquatic insects.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = regeneration, small sawtimber, or large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, or Ridge and Valley, and
- Live cavity tree = present.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Province (ignored) = central lowlands, Allegheny Plateau, or Ridge and Valley, and
- Live cavity tree = present.

Treatment Implications

Not available.

Small-footed Myotis (*Myotis leibii*)

Goal Description

The user wishes to create or enhance habitat for small-footed myotis.

Species Information—Species information includes the following:

Range: Southeastern Canada, west through the midwestern United States to eastern Washington, south to Mexico, western Texas and northern Georgia.

Relative abundance in New England: Uncommon.

Habitat: In or near woodland in caves, mine tunnels, buildings, crevices in rocks; maternity colonies have been observed in buildings; hibernates in cold, dry caves or mines from November to April (Pennsylvania); associated with caves in the foothills of mountains up to 610 m in coniferous woodlands (hemlock, spruce, white cedar).

Special habitat requirements: Tolerates cold, dry places for hibernation from mid-November to March.

Home range: Unknown.

Food habits: Unknown; probably similar to other myotids' flies, bugs, beetles, and ants found in stomachs of two specimens.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Size class = regeneration, small sawtimber, or large sawtimber, and
- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, Piedmont Plateau, or Coastal Plain.

Treatment Implications

Not available.

Smoky Shrew (*Sorex fumeus*)

Goal Description

The user wishes to create or enhance habitat for smoky shrew.

Species Information—Species information includes the following:

Range: Maritime Provinces, southern Quebec and Ontario, west to Lake Superior; southern Maine, south through parts of southern New England, Ohio, Kentucky, and Georgia.

Relative abundance in New England: Locally common to uncommon.

Habitat: Damp, boulder-strewn, and upland woods (often beech or maple, birch and hemlock) with thick leaf mold; typically near streams with moss-covered banks; also uses early clearcuts in coniferous woodlands.

Special habitat requirements: Loose damp leaf litter; does not burrow, uses runways of other small mammals in shady wooded areas.

Home range: Unknown.

Sample densities: Ranged from 12 to 123 individuals per ha in late summer.

Food habits: Mainly insectivorous (80%) but also eats earthworms, spiders, snails, salamanders, small mammals, and birds.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, or bottomland hardwoods, and
- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = northern hardwoods, and
- Size class = sapling, pole, small sawtimber, large sawtimber, or uneven-age, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = balsam fir, spruce-fir, red spruce, eastern hemlock, or white pine, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Snowshoe Hare (*Lepus americanus*)

Goal Description

The user wishes to create or enhance habitat for snowshoe hare.

Species Information—Species information includes the following:

Range: Newfoundland, west to Alaska, south along the northern United States border, and south in the Sierras, Rockies, and Appalachians.

Relative abundance in New England: Common in suitable habitat.

Habitat: Deciduous, coniferous, and mixed woodlands (less often deciduous) with dense brushy understory, coniferous swamps, cut-over areas, burns, nearly all types of forests, but favors second growth aspen-birch in vicinity of conifers; in eastern Maine, hare showed a significant shift in activity from coniferous understory in winter to hardwood understory in summer.

Special habitat requirements: Dense brushy cover.

Home range: Probably about 4 ha; about 10.1 ha for adult males and 7.7 ha for adult females on an island in northwestern Montana; daily ranges for both sexes were about 1.6 ha in mixed woodland-old field habitat in Canada.

Sample densities: Populations follow 10- or 11-year cycles with densities ranging from 0.4 per km^2 to approximately 100 per km^2.

Food habits: Mainly crepuscular and nocturnal; coprophagic. Summer—succulent vegetation such as clover, grasses, and ferns. Winter—twigs, buds, and bark of small trees and seedlings such as alder and balsam.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit “passes minimally.”

- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, red spruce, northern red oak, white pine/red oak/red maple, or white pine, or
- Size class = small sawtimber, or large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, or Coastal Plain, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, or Coastal Plain, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- Canopy closure > 70%.

Treatment Implications

Treatments may include the following:

- Maintaining a variety of deciduous and coniferous conditions across the landscape, and
- Maintaining dense understories of small trees and other woody plants.

Southern Bog Lemming (*Synaptomys cooperi*)

Goal Description

The user wishes to create or enhance habitat for southern bog lemming.

Species Information—Species information includes the following:

Range: Quebec, west to Manitoba, south to Kansas, Arkansas, Virginia, and Maryland.

Relative abundance in New England: Uncommon, in very scattered colonies.

Habitat: Uses a variety of habitat including marshes, open meadows and orchards, moist deciduous and mixed forests; favors sphagnum bogs and deciduous woodlands with a thick layer of loose duff; uses clearcuts and other small forest openings with adequate ground cover.

Special habitat requirements: Moist soils.

Home range: 0.40 ha for 1 individual in sphagnum bog with tamarack and black spruce forming a dense canopy; 0.08 to 0.20 ha; females defend nest.

Food habits: Tender parts of herbaceous plants, especially leaves, stems and seeds of gasses and sedges, and fruits; occasionally takes fungi, bark, and insects.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Temporary ponds = present, and
- Loose soils = present, and
- Ground layer percent cover > 75%, and
- Shrub layer percent cover > 50%, and
- Ericaceous shrub layer cover > 0%, and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = balsam fir, and
- Size class = regeneration or large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Temporary ponds = present, and
- Loose soils = present, and
- Ground layer percent cover > 75%, and
- Shrub layer percent cover > 50%, and
- Ericaceous shrub layer cover > 0%, and
- Percent cover of leaf litter > 30%.

OR

- HAM forest type = spruce-fir, and
- Size class = regeneration, small sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, Blue Ridge, New England lowlands, or Piedmont Plateau, and
- Temporary ponds = present, and

- Loose soils = present, and
- Ground layer percent cover > 75%, and
- Shrub layer percent cover > 50%, and
- Ericaceous shrub layer cover > 0%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Southern Flying Squirrel (*Glaucomys volans*)

Goal Description

The user wishes to create or enhance habitat for southern flying squirrel.

Species Information—Species information includes the following:

Range: Eastern North America from Nova Scotia, west to the Great Lakes and south to East Texas and southern Florida.

Relative abundance in New England: Common to uncommon.

Habitat: Mature deciduous and mixed forests especially beech-maple, oak-hickory, and aspen.

Special habitat requirements: Several nest sites per individual, mature woodland with cavity trees; favors cavities with entrance diameters of 40 to 50 mm.

Home range: Average 0.17 ha for females (may defend entire home range) and 0.21 ha for males (no defense) in oak-maple habitat in New York.

Sample densities: Densities of up to 12 individuals per ha have been reported in woodland in New York.

Food habits: Hickory and other nuts, acorns, seeds and fleshy fruits; also takes insects and occasionally birds' eggs and fledglings; most carnivorous of the squirrels; stores food in den for winter use.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Size class = small sawtimber, or large sawtimber, and
- Dead cavity tree = present, and
- Soft mast or hard mast = present

OR

- HAM forest type = northern hardwoods, and
- Size class = small sawtimber, large sawtimber, or uneven-age, and
- Dead cavity tree = present, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Southern Red-backed Vole (*Clethrionomys gapperi*)

Goal Description

The user wishes to create or enhance habitat for southern red-backed vole.

Species Information—Species information includes the following:

Range: Canadian Provinces, south in the United States in the Appalachians to northern Georgia and in the Rockies to southwestern New Mexico; also occurs in the northern border states.

Relative abundance in New England: Common.

Habitat: Cool moist deciduous, mixed, or coniferous forests among mossy rocks, logs, tree roots, or other cover; less commonly found near stone walls at woodland edges or near talus slopes; favors damp situations in coniferous or mixed woods; highest densities found in subclimax communities; uses young clearcuts in deciduous or coniferous woodlands and mixed forest.

Special habitat requirements: Water sources such as springs, brooks or bogs, and debris cover (fallen trees, stumps, rocks, and slash).

Home range: About 0.10 ha; about 0.23 ha for 1 female and 1.44 ha for 1 male in virgin hardwood forest in northern Michigan.

Food habits: Mainly green vegetation but also eats seeds, nuts, fungi, bark, insects, and carrion.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Province (ignored) = Allegheny Plateau, Ridge and Valley, Blue Ridge, or New England lowlands, and
- Permanent ponds or seeps or streams = present, and
- Loose soils = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Shrub layer percent cover > 50%, and
- Coniferous shrub layer or ericaceous shrub layer cover > 0%, and
- 30 < canopy closure ≤ 70%, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Star-nosed Mole (*Condylura cristata*)

Goal Description

The user wishes to create or enhance habitat for star-nosed mole.

Species Information—Species information includes the following:

Range: Southern Labrador, west to southwestern Manitoba, southeastern through northern Ohio, south in the Appalachians through western North Carolina and along the coast to the northeastern corner North Carolina.

Relative abundance in New England: Common to uncommon.

Habitat: Prefers low wet ground near bodies of water, swamps, wet meadows, and occasionally wet spots in fields or low-lying woods; has been found in mixed hardwood stands with dry soils near water.

Special habitat requirements: Wet, mucky humus.

Home range: About 0.4 ha.

Sample densities: Sample includes 24.7 individuals per ha have been reported in late winter in New York.

Food habits: Aquatic insects, earthworms, crustaceans, slugs, snails, isopods, small fish (occasionally), and small amounts of vegetable material; forages above ground at night.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = bottomland hardwoods, or spruce-fir, and
- Size class = regeneration or large sawtimber, and
- Permanent ponds or streams = present, and
- Loose soils = present, and
- Percent cover of leaf litter > 30%.

Treatment Implications

Not available.

Striped Skunk (*Mephitis mephitis*)

Goal Description

The user wishes to create or enhance habitat for striped skunk.

Species Information—Species information includes the following:

Range: Occurs throughout southern Canada, except coastal British Columbia and throughout the United States except the desert regions of the Southwest.

Relative abundance in New England: Common; semi-open country, woods and meadows, agricultural lands, suburban areas, and trash dumps; occurs from sea level to timberline.

Special habitat requirements: Dens; may be under houses, stumps, in stone walls, rock cavities, or abandoned burrows.

Home range: Nightly movements cover 0.6 to 1.35 km^2 increasing to 10.4 to 13 km^2 at night during breeding season.

Sample densities: Sample includes 12 skunks per km^2 during autumn peak on a 2.93 km^2 area of farmland, shrub and wooded ravine habitat in Pennsylvania; 22 per km^2 in winter on good habitat in Michigan.

Food habitats: Omnivorous diet includes insects, snails, small rodents, birds' eggs, fruits, grains, nuts, corn, grasses, buds, berries, garbage, and carrion; in summer, diet may be as much as 43% insects.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Loose soils = present, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Soft mast = present.

Treatment Implications

Not available.

Virginia Opossum (*Didelphis virginiana*)

Goal Description

The user wishes to create or enhance habitat for Virginia opossum.

Species Information—Species information includes the following:

Range: Throughout the eastern United States except northern New England; also occurs along the West Coast as a result of transplants and in parts of Central America.

Relative abundance in New England: Common to uncommon.

Habitat: Dry to wet wooded areas; commonly found in wet woods near rivers and swamps, less often in wooded uplands or cultivated fields; common near human habitation where they are attracted to garbage.

Special habitat requirements: Den usually in abandoned burrow, tree cavity, hollow log, or brush pile; water.

Home range: Not territorial; separate home ranges not maintained; average minimum range was 4.7 ha; range 0.1-23.5 ha for 29 opossums in East Texas; 6 to 16 ha; average minimum length of 25 elongate ranges in several habitats in Maryland was 1 km.

Food habits: Insects, worms, fruits, nuts, carrion, and garbage; almost any vegetable or animal food; also preys on voles, shrews, and moles.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Live cavity tree = present, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

White-footed Mouse (*Peromyscus leucopus*)

Goal Description

The user wishes to create or enhance habitat for white-footed mouse.

Species Information—Species information includes the following:

Range: Throughout most of the eastern United States except northern Maine, northern Minnesota, northern Wisconsin, Florida, and coastal sections of the southeastern United States; does not occur west of Arizona and Montana.

Relative abundance in New England: Common.

Habitat: Interiors and edges of deciduous, mixed, and coniferous forests from sea level to above treeline; clearcuts, brushy woodland clearing, pastures, streamside thickets, and buildings.

Home ranges: 0.06 to 0.22 ha for adult males and 0.02 to 0.15 ha for adult females in mature oak-hickory in southern Michigan.

Food habits: Seeds, acorns, nuts, fruits, tender green plants, insects, and small amounts of meat (carrion); commonly stores food for future use.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Coarse woody debris > 50 ft^3/ac (3.5 m^3/ha), and
- Shrub layer percent cover > 20%, and
- 15 < canopy closure ≤ 30%, and
- Hard mast = present.

Treatment Implications

Not available.

White-tailed Deer (*Odocoileus virginianus*)

Goal Description

The user wishes to create or enhance habitat for white-tailed deer.

Species Information—Species information includes the following:

Range: Across southern Canada to central British Columbia and throughout the United States, except for most of California, Nevada, Utah, and western Colorado; range extends into South America.

Relative abundance in New England: Common.

Habitat: Forest edges, swamp borders, areas interspersed with fields and woodland openings; during winter months when snow depth exceeds 40.6 cm; deer will "yard" in stands of conifers, forming a central resting area with trails packed through the snow.

Special habitat requirements: Dense cover for winter shelter, adequate browse.

Home range: 5.2 to 7.8 km^2; size depends on the quality of the habitat; home range is from 16.2 ha in excellent habitat to 121.5 ha in poor habitat.

Food habits: Mainly crepuscular; deer browse on a variety of woody deciduous plants and some coniferous growth, and feeding on twigs and stripping young bark; also graze on grasses, herbs and mushrooms, and grub for roots; adaptable in its food habits.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Ground layer percent cover > 75%, and
- Deciduous shrub layer cover > 0%.

Treatment Implications

Treatments may include the following:

- Maintaining deciduous forests or mixed deciduous and coniferous forests intermixed with fields and meadows,
- Maintaining trees that produce mast,
- Maintaining areas of dense understories of small trees and other woody plants, and
- Maintaining conifer stands or patches in areas with deep snow cover.

Woodland Jumping Mouse (*Napaeozapus insignis*)

Goal Description

The user wishes to create or enhance habitat for woodland jumping mouse.

Species Information—Species information includes the following:

Range: Canadian maritime provinces south to northern New Jersey and western Maryland, west to northeastern Ohio.

Relative abundance in New England: Locally common.

Habitat: Areas with herbaceous ground cover and low woody plants in both deciduous and coniferous forests, frequently in brush and herbaceous vegetation bordering streams, lakes, or ponds; uses recent clearcuts with herbaceous cover; seldom ventures into bare open areas.

Special habitat requirements: Moist cool woodland, loose soils for burrowing, herbaceous cover.

Home range: Average 3.63 ha for an adult male and 2.65 ha for an adult female; 0.40 to 2.63 ha for females and 0.40 to 3.64 ha for males in virgin hardwood forests in Michigan.

Food habits: Tender parts of herbaceous plants, roots, fruits, underground fungi, seeds, insect larvae and adults; does not cache food.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- Size class = sapling, pole, small sawtimber, or large sawtimber, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, New England lowlands, or Piedmont Plateau, and
- Ground layer percent cover > 75%, and
- Percent cover rock > 25%.

OR

- HAM forest type = northern hardwoods, and
- Size class = uneven-age, and
- Province (ignored) = central lowlands, Allegheny Plateau, Ridge and Valley, New England lowlands, or Piedmont Plateau, and
- Ground layer percent cover > 75%, and
- Percent cover rock > 25%.

Treatment Implications

Not available.

Woodland Vole (*Microtus pinetorum*)

Goal Description

The user wishes to create or enhance habitat for woodland vole.

Species Information—Species information includes the following:

Range: North central New England, west to central Wisconsin, south to eastern Texas and northern Florida.

Relative abundance in New England: Common to uncommon.

Habitat: Deciduous forests, grasslands, meadows, and orchards; occurs in marshes and swamps but favors well drained uplands.

Special habitat requirements: May require ground cover of leaves (duff) or grass; moist well drained soils.

Home range: About 0.10 ha in oak-hickory woods in Michigan; home ranges of voles in Connecticut had average maximum diameters of 33.7 m for females and 32.7 m for males.

Sample densities: Densities ranged from 0 to 14.6 individuals per ha in upland oak woods.

Food habits: Subterranean tubers, roots and bulbs; seeds, nuts, fruits, bark, and leaves; often caches large amounts of food in burrows.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- If at least one stand in the management unit passes the stand level DFCs, then the management unit "passes minimally."
- If no stand in the management unit passes the stand level DFCs, then the management unit "fails."

Stand level:

- HAM forest type = aspen, birch, northern hardwoods, bottomland hardwoods, northern red oak, or white pine/red oak/red maple, and
- Loose soils = present, and
- Ground layer percent cover > 75%, and
- Ericaceous shrub layer cover > 0%, and
- Percent cover of leaf litter > 30%, and
- Soft mast or hard mast = present.

Treatment Implications

Not available.

Ecology Goals

Enhance Regional Biological Diversity

Goal Description

The landowner desires to manage this unit to contribute to regional species, genetic, habitat, and ecosystem diversity, by preserving or establishing those elements that are rare or unique in the region defined by the physiographic province in which it is located.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Rare species = "present"; or
- At least one stand satisfies the stand level DFCs

Stand level: One or more of the following conditions must be present:

- Wetland = “yes”, or
- Contains a wetland = “yes”, or
- Riparian = “yes”, or
- Contains a riparian = “yes”, or
- Old growth = “yes”, or
- Size class is regeneration.

One of the most important contributions that any landowner can make to regional biological diversity is to conduct a thorough inventory of the species and communities, including non-woody plants, within this management unit. Such an inventory should be preceded with a search of the Natural Heritage Program database, may require several passes through the management unit, and should be preserved for comparison with future complete inventories. If any special plants or communities are detected during the inventory, the landowner might choose to report these to the Natural Heritage Program.

Selection of this goal should coincide with a search of a regional database to identify forest types and ecological conditions that are rare or unique in the geographic region of the management unit.

An inventory should be designed to check for regionally rare forest types, or unique/rare conditions such as stands with old-growth or potential old-growth characteristics (in species composition, size of large live and dead trees, and amount of down dead wood), and for stands that are or contain wetlands and riparian zones.

Treatment Implications

It is recommended that those unique elements should be preserved or enhanced that are adapted to the site conditions and natural vegetation in this management unit. On small management units, this could lead to domination of the entire unit by a few ecological conditions (it could lead to low local diversity). This is done to increase the acreage of rare of unique conditions in the region as a whole, such as old-growth stands or rare forest types.

If other goals are also selected, the user should place restrictions on practices that reduce genetic variability (such as thinning that eliminates all trees that exhibit slow growth or epicormic branch development), take measures to maintain minor tree species by protecting them against removal during cuttings and ensuring their regeneration, and make special efforts to maintain the temporal and spatial arrangements of these varied vegetative conditions.

With the selection of this goal and knowledge of stands within the management unit that contain wetland or riparian areas, you may also be interested in the following water goals:

- Provide intensive protection of wetlands
- Provide protection of riparian areas

Enhance Local Biological Diversity

Goal Description

The owner desires to manage this unit for plant and animal species richness; to preserve or establish plants, plant associations, and habitats that are unique to this local area.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Percent of area in large saw + percent of area in small sawtimber > 20%, and
- Percent of area in sapling + percent of area in pole > 10%, and
- Percent of area in regeneration > 10%, and
- Openings > 5% or water present

Selection of this goal will result in an assessment of the variety of stand conditions and stand age classes within the management unit. Specifically, NED will look for some openings and some stands in all age/size classes. This is because a wide variety of vegetative conditions will perpetuate the maximum number of plant species and provide habitat for the maximum number of animal species.

Treatment Implications

The user may choose to establish some of nearly all feasible conditions on this management unit regardless of their abundance or uniqueness regionally. On small management units, this could lead to exclusion of organisms that require large areas or specialized conditions.

If other goals are also selected, the user should place restrictions on practices that reduce genetic variability (such as thinning that eliminates all trees that exhibit slow growth or epicormic branch development), take measures to maintain minor tree species by protecting them against removal during cuttings and ensuring their regeneration, and make special efforts to maintain the temporal and spatial arrangements of these varied vegetative conditions.

Several widely different silvicultural systems may be necessary to accomplish this goal in the management unit, in an attempt to create and maintain a wide variety of vegetative conditions to perpetuate the maximum number of plant species and provide habitat for the maximum number of animal species.

Promote a Variety of Forest Types in this Management Unit

Goal Description

The landowner desires to create and maintain a variety of native forest types in this management unit.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- Management unit area ≤ 100 acres, and
- Number of forest types ≥ 2.

OR

- Management unit area is > 100 acres, and
- Number of forest types ≥ 3.

Selection of this goal will result in a search for different forest types on the management unit. If forest-type variety (as defined in the desired future conditions for this goal) is found, then the goal will be assessed as satisfied.

Treatment Implications

If analysis of your management unit indicates a low variety of forest types, use the Forest Type Transition Matrix (see Figure 1) to develop treatments that may increase the number of forest types. The matrix is designed to help users determine which silvicultural systems may help to maintain present forest types or convert them to different types.

If you have abundant seed sources for shade-intolerant species within a forest type dominated by shade-tolerant species, you might consider initiating a regeneration treatment in that part of the forest to promote a forest type dominated by shade-intolerant species.

If much of your forest is already dominated by shade-intolerant species, but you have a seed source for shade-tolerant species, you might forego or lighten harvests in certain areas to favor the shade-tolerant species.

Forest types should be favored on the sites within the management unit best adapted to each type, without attempting to balance or equalize the acreage in each type.

Discourage Exotic Elements

Goal Description

The user desires to reduce or eliminate exotic or nonnative plants detected in the inventory.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- 100% of the stands satisfy the stand DFC.

Stand level:

- Exotics = “absent.”

Selection of this goal will lead to an assessment of the inventory data collected in this management unit for exotic species. This will be effective only if the NED user has annotated the plant species list to show which species are exotic locally. If exotic species are detected, the landowner may want to consider treatments to reduce their importance or remove them.

Treatment Implications

Often, consultation with a service forester or cooperative extension representative will help identify specific treatments, which may range among manual, chemical, or prescribed-fire removal for certain exotic plants, and through selective removal combined with chemical treatments (cut stump, hack and squirt, etc.) during forest management activities for exotic timber species.

Protect Riparian and Wetland Habitats

Goal Description—Descriptions of goals are as follows:

Riparian protection: The landowner wants to pay special attention to protecting water quality and the unique flora and fauna found in riparian areas.

Wetlands protection: Landowners are required by law to follow special precautions on wetlands; selection of this goal indicates that the landowner wants to pay special attention to wetlands and the unique flora and fauna found there.

Note: Evaluation of the goals is treated within NED-2 through the following subgoals:

- Provide intensive protection of wetlands
- Provide protection of riparian areas.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

- DFCs for the provide intensive protection of wetlands subgoal.
- DFCs for the provide protection of riparian areas subgoal.

Treatment Implications—Treatments may include the following:

Riparian protection: The riparian area is the transition between aquatic and terrestrial characteristics of soil, water, vegetation, and landform. Riparian areas contain unique species associations and are especially important to protecting water quality and the food chain and physical structure of aquatic habitats. Best Management Practices normally call for leaving buffer strips of one or more tree heights on both sides of perennial stream channels to protect the stream and riparian area.

Selection of this goal may not affect the silvicultural system intended for the management unit as a whole, but may result in the delineation of a riparian management unit. Such units may incorporate land areas surrounding intermittent streams.

Landowners should consult with a service forester or cooperative extension representative to obtain recommendations about designing riparian stands or buffer strips and managing within them.

Wetlands protection: Management of wetlands is problematical. Definitions of wetlands are not always consistent from place to place, and delineation of wetlands can be subjective. Wetland silviculture is subject to regulations under the Federal Clean Water Act.

Landowners may want to consult with a service forester or cooperative extension representative for assistance in determining if their management unit does have a wetland, and to obtain guidelines for managing wetlands to comply with laws and regulations, and for protecting both the site and water quality.

Wildland-Urban Fire Risk

Manage Fire Risk

Goal Description

Fire is the dominant fact of forest history (Spurr 1964). The effects of fire can be entirely beneficial, or it can have disastrous effects on certain sites, and it may cause substantial damage/loss of property located near undeveloped, natural areas.

This goal could be selected by forest managers, landowners, and homeowners working within any fire-prone landscape, in order to reduce uncertainty, identify fire risk, and improve decisionmaking in the wildland-urban interface (WUI) as well as in forested wildlands.

The Manage Fire Risk goal evaluates the wildfire risk both to the buildings at the WUI, and to the wildland vegetation in the stands.

Desired Future Conditions

To achieve this goal, the following DFCs must be met:

Management unit level:

- In the WUI, all buildings or manmade structures must be rated “low” or “moderate” for damage/loss because of fire in the landscape.
- At least 90% of the land area of the management unit must have a low to moderate wildland fire hazard rating (“very low,” “low,” or “moderate”).
- Of the set of stands that have a significant fire hazard (“high” or above), those stands must not be adjacent to other stands that have an equal fire hazard (“high” or above).
- All stands must satisfy the stand level DFCs.

Stand level:

- Wildland fire hazard must not be rated "very high."

The fire hazard rating is performed according to the fire models available in the geographic region of the management unit. Currently, the Southern Wildfire Risk Assessment is available for the southern United States.

Goal Analysis Report

The Manage Fire Risk goal analysis report indicates whether the potential risk from fire has been sufficiently provided for, given the conditions of the management unit at a specific point in time, under "routine" weather conditions. The report provides several tables that contain specific details of the analysis, allowing readers to evaluate the degree of success or failure and to examine for conditions that can be remedied. A management unit summary table provides totals and percentages of buildings and stands that fall under various levels of risk in the management unit, according to specific fire risk models that pertain to the locale of the management unit. A buildings summary table shows the risk assessments of individual buildings, a stand summary table shows the risk assessments of individual stands, and a missing data table lists missing data for each building and stand.

Treatment Implications

Treatments may include actions that could increase the survivability of a building or structure in the event that a wildfire occurs, such as modifying a building design or replacing building materials or other related elements, as well as specific vegetation treatments to prevent or reduce the impacts of wildfire, including prescribed burning, mowing and thinning, chemical treatments, animal grazing, and creating fire breaks.

Wildfire Risk Assessment in the Southern United States

For the southern United States, NED-2 uses three distinct models for evaluating wildfire risk (Routh 2004):

1. The Long (2004) WUI risk model assesses the fire risk to buildings within the management unit.
2. The Hemel et al. (2005) wildland risk model assesses the fire risk to forested stands within the management unit.
3. Anderson (1982) provides fuel load models which are used to assess fire risk to non-forested stands within the management unit as well as being one component of the Long WUI model.

The Long WUI model (2004) evaluates urban interface risk based on a fuels component, and a structural (buildings) component. The hazardous fuel component assesses the vegetation around a building. The structural hazard component identifies potentially hazardous characteristics of a building based on its design and construction materials. During a wildfire, the survivability of a building depends on the types of vegetation surrounding a building, along with the construction detail of the building.

In assessing fire risk to buildings, the Long WUI model assigns qualitative risk ratings of "low," "moderate," "high," or "very high." Ratings are determined by assigning risk factor points for the hazardous fuel component and for the structural hazard component. The total risk points are used to assign a risk assessment rating. The higher the number of points, the greater the fire risk.

If a building contains multiple risk factors, only the points associated with the highest risk factor are used (Routh 2004). NED reports stand-level fire risk using the maximum fire risk rating of any building in the stand.

The following is a list of NED-2 variables used by the Long WUI model in evaluating wildfire risk to buildings:

- Land cover type
- Distance to nearest adjacent building
- Defensible space around a building
- Building on a steep slope (>30%)
- Wooden shingles or shakes on a building
- Wooden or vinyl siding on a building
- Wooden deck on a building
- Open or vinyl soffits on a building
- Single pane windows on a building
- Open foundation of a building
- Wooden fence attached to a building
- Stacked firewood near a building

In the case where variables may not have been measured for a particular stand, such as aspect, slope, or topographic position, NED-2 cannot definitively provide a risk rating. In such cases, the worst case scenario is assumed when assigning a possible risk rating to a stand and is reported in parentheses on the fire risk report. For example, for steepness of slope (slope percent), the worst case of ">30%" is assumed.

The Hemel wildland risk model (Hemel et al. 2005) assigns wildland fire risk assessments to individual stands based on forest composition, landform, aspect, slope, canopy structure, fine debris, medium debris, and ladder fuels. These variables were selected based on their influence on the likelihood of ignition and fire behavior (Hemel et al. 2005).

During the assessment, qualitative risk ratings of "very low," "low," "moderate," "high," and "very high" are assigned. For non-forested stands, an appropriate Anderson fuel model is selected and assigned fire risk based on the hazardous fuel component of the Long WUI model (Long and Randall 2004) as implemented in NED-2.

The following is a list of NED-2 variables used by the Hemel et al. (2005) wildland risk model in evaluating the wildfire risk for individual stands:

- Land cover type
- Topographic position
- Aspect
- Slope
- Effective age
- Wetland status (y/n)
- Percent basal area in coniferous and hardwood species
- Percent canopy closure
- Height to bottom of canopy
- Percent cover of midstory coniferous species
- Percent shrub cover and average shrub height
- Percent ground cover
- Percent litter cover and litter depth
- Low slash and high slash
- Coarse woody debris average diameter

Appendix B - Variable Descriptions

Plant Species Attributes

Species Biological Characteristics

Plant Species Variable - Growth Form

Description: Growth form of mature plant.

Valid values: Growth Form must be 1="Forb/herb", 2="Graminoid", 3= "Lichenous", 4="Liana", 5="Nonvascular", 6="Shrub", 7="Subshrub", 8="Tree", or 9="Vine".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Other variables using plant species - growth form: Percent Grass and Sedge, Foliage Biomass, Aboveground Biomass, Relative Density, Coarse Root Biomass, Q Factor, Year of Maturity, Merchantable quadratic mean dbh, Merchantable medial dbh, Quadratic Mean DBH, Medial DBH, Average DBH, Stem Bark Biomass, Percent Basal Area Hardwoods, Stem Wood Biomass, Trees with Showy Flowers, Trees with Fruits and Nuts, Fall Color Trees, Number of Big Trees Per Unit Area, Effective Age, Total Biomass, Percent Basal Area Conifer, Basal Area.

Plant Species Variable - Shade Tolerance

Description: Shade tolerance of species.

Valid values: Shade Tolerance must be 1="very intolerant", 2="intolerant", 3="intermediate", 4="tolerant", or 5="very tolerant".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Plant Species Variable - Wetland Species

Description: Species is characteristic of wetland habitat.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Other variables using plant species - wetland species: Understory Plot Wetland Vegetation, Ground Plot Wetland Vegetation.

Plant Species Variable - Evergreen

Description: Species retains vegetation all year.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Other variables using plant species - evergreen: Percent Basal Area Evergreen, Understory Plot Deciduous Shrub Layer, Ground Plot Deciduous Shrub Layer.

Plant Species Variable - Ericaceous

Description: Species belongs to the family Ericaceae.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Other variables using plant species - ericaceous: Understory Plot Ericaceous Shrub Layer, Ground Plot Ericaceous Shrub Layer.

Plant Species Variable - Rare

Description: Species is rare, threatened, or endangered in the region.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Other variables using plant species - rare: Rare Plants Present.

Plant Species Variable - Exotic

Description: Species not native to the region.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Other variables using plant species - exotic: Exotic Plants Present.

Plant Species Variable - Showy Flowers

Description: Species typically produces showy flowers.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Other variables using plant species - showy flowers: Trees with Showy Flowers, Ground Plot Flowery Shrub Layer, Understory Plot Flowery Shrub Layer, Flowery Ground Layer.

Plant Species Variable - Showy Bark

Description: Species typically produces showy bark.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Plant Species Variable - Fall Color

Description: Species typically produces showy fall color.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Other variables using plant species - fall color: Fall Color Trees, Understory Plot Cover of Fall Color in Shrub Layer, Ground Plot Cover of Fall Color in Shrub Layer, Cover of Fall Color in Ground Layer.

Plant Species Variable - Mast Type

Description: Type of mast produced as food for wildlife.

Valid values: Mast type must be 0=“none”, 1=“hard”, 2=“soft”, or 3=“hard and soft”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Other variables using plant species - mast type: Understory Plot Soft Mast, Understory Plot Hard Mast, Hard Mast Present, Overstory Plot Soft Mast, Ground Plot Soft Mast, Ground Plot Hard Mast.

Plant Species Variable - Showy or Edible Fruit

Description: Species typically produces showy or edible fruit.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: No.

Other variables using plant species - showy or edible fruit: Trees with Fruits and Nuts, Understory Plot Cover of Fruiting Plants in Shrub Layer, Ground Plot Cover of Fruiting Plants in Shrub Layer, Cover Of Fruiting Plants in Ground Layer.

Species Timber Characteristics

Plant Species Variable - Cubic-foot Correction Factor

Description: Correction factor for cubic-foot volume estimates.

Valid values: Cubic-foot correction factor must be greater than or equal to zero.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 1.0.
User-set default: No.
Calculated: No.

Other variables using plant species - cubic-foot correction factor: Gross Cubic Volume.

Plant Species Variable - Board-foot Volume Correction Factor

Description: Correction factor for board-foot volume estimates.

Valid values: Board-foot volume correction factor must be greater than or equal to zero.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 1.0.
User-set default: No.
Calculated: No.

Other variables using plant species - board-foot volume correction factor: Gross Board-foot Volume.

Plant Species Variable - Girard Form Class

Description: Girard form class for taper.

Valid values: Girard form class must be between 0 and 100.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: No.
NED default value: 80.
User-set default: No.
Calculated: Yes.

70 if symbol is one of the following:
- SOAM3 (American mountain ash)
- SOAU (European mountain ash)

78 if symbol is one of the following:
- ACACI (acacia)
- ACGR3 (bigtooth maple)
- ACMA3 (bigleaf maple)
- ACPE (striped maple)
- BEAL2 (yellow birch)
- BELE (sweet birch)
- BENI (river birch)
- BEOC2 (water birch)
- BEPA (paper birch)
- BEPO (gray birch)
- BETUL (birch)
- CAAL27 (mockernut hickory)
- CAAQ2 (water hickory)
- CACA18 (American hornbeam)
- CACO15 (bitternut hickory)
- CAGL8 (pignut hickory)
- CAIL2 (pecan)
- CALA21 (shellbark hickory)
- CAOV2 (shagbark hickory)
- CARYA (hickory)
- CATE9 (black hickory)
- LIST2 (sweetgum)
- LITU (tuliptree)
- NYSY (blackgum)
- OSVI (hophornbeam)
- OXAR (sourwood)
- PODE3 (eastern cottonwood)
- QUAL (white oak)
- QUBE5 (scrub oak)
- QUBI (swamp white oak)
- QUFA (southern red oak)
- QUGA (Gambel oak)
- QUHY (silverleaf oak)
- QUWI2 (interior live oak)
- TAAS (pond cypress)
- TABR2 (Pacific yew)
- TADI2 (bald cypress)
- TSCA (eastern hemlock)
- TSCA2 (Carolina hemlock)
- TSHE (western hemlock)
- TSME (mountain hemlock)
- TSUGA (hemlock)

79 if symbol is one of the following:
- ACBA3 (southern sugar maple)
- ACER (maple)
- ACNI5 (black maple)
- ACRU (red maple)
- ACSA2 (silver maple)
- ACSA3 (sugar maple)

82 if symbol is one of the following:

AEFL (yellow buckeye)
AEGL (Ohio buckeye)
AESCU (buckeye)
AESCU (buckeye)
ARBUT (madrone)
ARME (Pacific madrone)
ASTR (pawpaw)
CABI8 (southern catalpa)
CADE12 (American chestnut)
CAPU9 (chinkapin)
CAPUO (Ozark chinkapin)
CASP8 (northern catalpa)
CATAL (catalpa)
CELA (sugarberry)
CELTI (hackberry)
CEOC (common hackberry)
CHCH7 (Golden (giant) chinkapin)
CHRYS15 (chinkapin)
CLKE (Kentucky yellowwood)
DIVI5 (common persimmon)
FRAM2 (white ash)
FRAXI (ash)
GLAQ (water locust)
GLTR (honeylocust)
GYDI (Kentucky coffeetree)
JUCI (butternut)
JUGLA (walnut)
JUNI (black walnut)
LIDE3 (tanoak)
MAAC (cucumber-tree)
MAFR (mountain magnolia)
MAGNO (magnolia)
MAGR4 (southern magnolia)
MALUS (apple)
MALUS (apple)
MAMA2 (bigleaf magnolia)
MAVI2 (sweetbay)
MOAL (white mulberry)
MORU2 (red mulberry)
MORUS (mulberry)
NYAQ2 (water tupelo)
NYBI (swamp tupelo)
NYOG (Ogeechee tupelo)
NYSSA (tupelo)
PATO2 (princesstree)
PIAB (Norway spruce)
PIAL (whitebark pine)
PIAR (bristlecone pine)
PIAT (knobcone pine)
PIBA (foxtail pine)
PIBA2 (jack pine)
PIBR (Brewer spruce)
PICL (sand pine)
PICO (lodgepole pine)
PICO3 (Coulter pine)
PIEC2 (shortleaf pine)
PIEL (slash pine)
PIEN (Engelmann spruce)
PIEN2 (Apache pine)
PIFL2 (limber pine)
PIGL (white spruce)
PIGL2 (spruce pine)
PIJE (Jeffrey pine)
PILA (sugar pine)
PILE (Chihuahuan pine)
PIMA (black spruce)
PIMO3 (western white pine)
PIMU (Bishop pine)
PINUS (pine)
PINUS (pine)
PIPA2 (longleaf pine)
PIPO (ponderosa pine)
PIPU (blue spruce)
PIPU5 (Table Mountain pine)
PIRA2 (Monterey pine)
PIRE (red pine)
PIRI (pitch pine)
PIRU (red spruce)
PISA2 (California foothill pine)
PISE (pond pine)
PISI (Sitka spruce)
PIST3 (southwestern white pine)
PISY (Scotch pine)
PITA (loblolly pine)
PIVI2 (Virginia pine)
PLATA (sycamore)
PLOC (American sycamore)
PLRA (California sycamore)
POAL7 (white poplar)
POAN3 (narrowleaf cottonwood)
POAN3 (narrowleaf cottonwood)
POBA2 (balsam poplar)
POBAT (black cottonwood)
PODEM (plains cottonwood)
POFR2 (Fremont cottonwood)
POGR4 (bigtooth aspen)
POHE4 (swamp cottonwood)
POPUL (cottonwood)
POTR5 (quaking aspen)
PRSE2 (black cherry)
PSEUD7 (Douglas-fir)
PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)
QUCO2 (scarlet oak)
QUEL (northern pin oak)
QUERC (oak)
QUIL (bear oak)
QUIM (shingle oak)
QUIN (bluejack oak)
QUKE (California black oak)
QULA2 (turkey oak)
QULA3 (laurel oak)
QULO (California white oak)
QULY (overcup oak)
QUMA2 (bur oak)
QUMA3 (blackjack oak)
QUMI (swamp chestnut oak)
QUMU (chinkapin oak)
QUNI (water oak)
QUOB (Mexican blue oak)
QUPA2 (pin oak)
QUPA5 (cherrybark oak)
QUPH (willow oak)
QUPR2 (chestnut oak)
QUSH (Shumard's oak)
QUSI2 (bottomland post oak)
QUSIS (bastard oak)
QUST (post oak)
QUTE (Texas red oak)
QUVE (black oak)
QUVI (live oak)
ROPS (black locust)
SAAM2 (peachleaf willow)
SAER (Missouri River willow)
SALIX (willow)
SANI (black willow)
THOC2 (arborvitae)
THPL (western red cedar)
ULAL (winged elm)
ULAM (American elm)
ULCR (cedar elm)
ULMUS (elm)
ULPU (Siberian elm)
ULRU (slippery elm)
ULSE (September elm)
ULTH (rock elm)
VEFO (tungoil tree)

84 if symbol is one of the following:

FAGR (American beech)
SEGI2 (giant sequoia)
SESE3 (redwood)

80 if symbol is not listed above

Variables used in calculation: Symbol
Other variables using plant species - Girard form class: Gross Board-foot Volume.

Plant Species Variable - Tons Per Cord

Description: Conversion for tons per cord.

Valid values: Tons per cord must be greater than or equal to zero.
Units: Tons per cord or metric tons per cord.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No. Enter conversion for tons per cord. The default of 2 assumes that the average weight of a cord of wood is 4,000 pounds.
NED default value: 2.0.
User-set default: No.
Calculated: Yes.

This variable will be displayed according to the preference setting for "Tons per cord"

Variables used in calculation: Tons Per Cord.

Other variables using plant species - tons per cord: Gross Tons, Net Tons.

Plant Species Variable - Price for Veneer

Description: Price of veneer used in value calculation.

Valid values: Price for veneer must be greater than or equal to zero.
Units: Dollars per thousand board feet.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for veneer: Dollar Value.

Plant Species Variable - Price for Grade 1 Sawtimber

Description: Price of grade 1 sawtimber used in value calculation.

Valid values: Price for grade 1 sawtimber must be greater than or equal to zero.
Units: Dollars per thousand board feet.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for grade 1 sawtimber: Dollar Value.

Plant Species Variable - Price for Grade 2 Sawtimber

Description: Price of grade 2 sawtimber used in value calculation.

Valid values: Price for grade 2 sawtimber must be greater than or equal to zero.
Units: Dollars per thousand board feet.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for grade 2 sawtimber: Dollar Value.

Plant Species Variable - Price for Grade 3 Sawtimber

Description: Price of grade 3 sawtimber used in value calculation.

Valid values: Price for grade 3 sawtimber must be greater than or equal to zero.
Units: Dollars per thousand board feet.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for grade 3 sawtimber: Dollar Value.

Plant Species Variable - Price for Subfactory Sawtimber

Description: Price of subfactory sawtimber used in value calculation.

Valid values: Price for subfactory sawtimber must be greater than or equal to zero.
Units: Dollars per thousand board feet.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for subfactory sawtimber: Dollar Value.

Plant Species Variable - Price for Boltwood

Description: Price of boltwood used in value calculation.

Valid values: Price for boltwood must be greater than or equal to zero.
Units: Dollars per 100 cubic feet or dollars per cubic meter.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for boltwood: Dollar Value.

Plant Species Variable - Price for Whole Pulpwood

Description: Price of whole pulpwood used in value calculation.

Valid values: Price for whole pulpwood must be greater than or equal to zero.
Units: Dollars per 100 cubic feet or dollars per cubic meter.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for whole pulpwood: Dollar Value.

Plant Species Variable - Price for Chipped Pulpwood

Description: Price of chipped pulpwood used in value calculation.

Valid values: Price for chipped pulpwood must be greater than or equal to zero.
Units: Dollars per 100 cubic feet or dollars per cubic meter.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for chipped pulpwood: Dollar Value.

Plant Species Variable - Price for Firewood

Description: Price of firewood used in value calculation.

Valid values: Price for firewood must be greater than or equal to zero.
Units: Dollars per 100 cubic feet or dollars per cubic meter.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for firewood: Dollar Value.

Plant Species Variable - Price for Local Use

Description: Price of local use wood used in value calculation.

Valid values: Price for local use must be greater than or equal to zero.
Units: Dollars per 100 cubic feet or dollars per cubic meter.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: No.

Other variables using plant species - price for local use: Dollar Value.

Plant Species Variable - Timber Value Class

Description: Timber value class of species.

Valid values: Timber value class must be 1=“high value”, 2=“commercial”, or 3=“non-commercial”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: No.
NED default value: commercial.
User-set default: No.
Calculated: Yes.

"high value" if the species is one of the following:

NED002 (unidentified high value softwood)
NED005 (unidentified high value hardwood)
JUNI (black walnut)
PATO2 (princesstree)
PRSE2 (black cherry)
QUAL (white oak)
QUFA (southern red oak)
QUPA5 (cherrybark oak)
QURU (northern red oak)

"commercial" if the species is one of the following:

ABAM (Pacific silver fir)
ABBA (balsam fir)
ABCO (white fir)
ABFR (Fraser fir)
ABGR (grand fir)
ABIES (fir)
ABLA (subalpine fir)
ABLAA (corkbark fir)
ABMA (California red fir)
ABPR (noble fir)
ABSH (Shasta red fir)
ACBA3 (southern sugar maple)
ACER (maple)
ACNE2 (boxelder)
ACNI5 (black maple)
ACRU (red maple)
ACSA2 (silver maple)
ACSA3 (sugar maple)
AECA (California buckeye)
AEFL (yellow buckeye)
AEGL (Ohio buckeye)
AESCU (buckeye)
AESCU (buckeye)
ALRH2 (white alder)
ALRU2 (red alder)
ARBUT (madrone)
ARME (Pacific madrone)
BEAL2 (yellow birch)
BELE (sweet birch)
BEPA (paper birch)
BEPAC (western paper birch)
BETUL (birch)
JUMO (oneseed juniper)
JUNIP (juniper)
JUOS (Utah juniper)
JUSC2 (Rocky Mountain juniper)
JUVI (eastern redcedar)
JUVIS (southern redcedar)
LADE2 (European larch)
LAKA2 (Japanese larch)
LALA (tamarack)
LALY (subalpine larch)
LAOC (western larch)
LIDE3 (tanoak)
LITU (tuliptree)
MAAC (cucumber-tree)
MAGNO (magnolia)
NED001 (unidentified commercial softwood)
NED004 (unidentified commercial hardwood)
NYAQ2 (water tupelo)
NYBI (swamp tupelo)
NYOG (Ogeechee tupelo)
NYSSA (tupelo)
NYSY (blackgum)
PIAB (Norway spruce)
PIAL (whitebark pine)
PIAR5 (Arizona pine)
PIBA (foxtail pine)
PIBA2 (jack pine)
PIBR (Brewer spruce)
PICEA (spruce)
PICL (sand pine)
PICO (lodgepole pine)
PICO3 (Coulter pine)
PLRA (California sycamore)
POAL7 (white poplar)
POAN3 (narrowleaf cottonwood)
POAN3 (narrowleaf cottonwood)
POBA2 (balsam poplar)
POBAT (black cottonwood)
PODE3 (eastern cottonwood)
PODEM (plains cottonwood)
POFR2 (Fremont cottonwood)
POGR4 (bigtooth aspen)
POHE4 (swamp cottonwood)
POPUL (cottonwood)
POTR5 (quaking aspen)
PSEUD7 (Douglas-fir)
PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)
QUAG (California live oak)
QUAR (Arizona white oak)
QUBI (swamp white oak)
QUCO2 (scarlet oak)
QUEL (northern pin oak)
QUERC (oak)
QUERC (oak)
QUGA4 (Oregon white oak)
QUHY (silverleaf oak)
QUIM (shingle oak)
QUIN (bluejack oak)
QUKE (California black oak)
QULA3 (laurel oak)
QULO (California white oak)
QULY (overcup oak)
QUMA2 (bur oak)

"commerical" species continued:

BETUL (birch)
CAAL27 (mockernut hickory)
CAAQ2 (water hickory)
CABI8 (southern catalpa)
CACO15 (bitternut hickory)
CADE12 (American chestnut)
CADE27 (incense cedar)
CAGL8 (pignut hickory)
CAIL2 (pecan)
CALA21 (shellbark hickory)
CAOV2 (shagbark hickory)
CAPU9 (chinkapin)
CAPUO (Ozark chinkapin)
CARYA (hickory)
CASP8 (northern catalpa)
CATAL (catalpa)
CATE9 (black hickory)
CELTI (hackberry)
CEOC (common hackberry)
CHAMA4 (cedar)
CHCH7 (giant chinquapin)
CHLA (Port Orford cedar)
CHNO (Alaska cedar)
CHRYS15 (chinquapin)
CHTH2 (Atlantic white cedar)
CUAR (Arizona cypress)
CUPRE (cypress)
EUCAL (gum)
FAGR (American beech)
FRAM2 (white ash)
FRAXI (ash)
FRNI (black ash)
FRPE (green ash)
JUCA7 (California juniper)
JUCI (butternut)
JUGLA (walnut)
PICO3 (Coulter pine)
PIEC2 (shortleaf pine)
PIEL (slash pine)
PIEN (Engelmann spruce)
PIEN2 (Apache pine)
PIFL2 (limber pine)
PIGL (white spruce)
PIGL2 (spruce pine)
PIJE (Jeffrey pine)
PILA (sugar pine)
PILE (Chihuahuan pine)
PIMA (black spruce)
PIMO (singleleaf pinyon)
PIMO3 (western white pine)
PIMU (Bishop pine)
PINI (Austrian pine)
PINUS (pine)
PINUS (pine)
PIPA2 (longleaf pine)
PIPO (ponderosa pine)
PIPU (blue spruce)
PIPU5 (Table Mountain pine)
PIRA2 (Monterey pine)
PIRE (red pine)
PIRI (pitch pine)
PIRU (red spruce)
PISA2 (California foothill pine)
PISE (pond pine)
PISI (Sitka spruce)
PIST (eastern white pine)
PIST3 (southwestern white pine)
PISY (Scotch pine)
PITA (loblolly pine)
PIVI2 (Virginia pine)
PLATA (sycamore)
PLOC (American sycamore)
QUMA2 (bur oak)
QUMA3 (blackjack oak)
QUMI (swamp chestnut oak)
QUMU (chinkapin oak)
QUNI (water oak)
QUOB (Mexican blue oak)
QUPA2 (pin oak)
QUPH (willow oak)
QUPR2 (chestnut oak)
QUSH (Shumard's oak)
QUSI2 (bottomland post oak)
QUST (post oak)
QUTE (Texas red oak)
QUVE (black oak)
QUVI (live oak)
QUWI2 (interior live oak)
ROPS (black locust)
SEGI2 (giant sequoia)
SESE3 (redwood)
TAAS (pond cypress)
TABR2 (Pacific yew)
TADI2 (bald cypress)
THOC2 (arborvitae)
THPL (western red cedar)
TIAM (American basswood)
TIAMH (American basswood)
TILIA (basswood)
TRSE6 (tallowtree)
TSCA (eastern hemlock)
TSCA2 (Carolina hemlock)
TSHE (western hemlock)
TSME (mountain hemlock)
TSUGA (hemlock)
ULAM (American elm)
ULMUS (elm)

"non-commercial" if the species is not listed above

Variables used in calculation: Symbol.

Other variables using plant species - timber value class: Percent Basal Area Commercial, Percent Basal Area High Value.

FIA Codes

There are approximately 400 woody species for which USDA Forest Inventory and Analysis (FIA) codes are known. For some species, if duplicate FIA codes exist, multiple codes will appear for those species. If you have different FIA codes that you wish to apply, follow the instructions for establishing them as user codes for the appropriate species. Refer to the topic on Identifying Plant Species for further information on handling FIA codes.

Species	FIA code
acacia *(Acacia*)	300
ailanthus *(Ailanthus*)	340
Alaska cedar *(Chamaecyparis nootkatensis*)	42
alder *(Alnus*)	350
alderleaf mountain mahogany *(Cercocarpus montanus*)	476
alligator juniper *(Juniperus deppeana*)	63
alternateleaf dogwood *(Cornus alternifolia*)	492
American basswood *(Tilia americana*)	951
American basswood *(Tilia americana var. heterophylla*)	952
American beech *(Fagus grandifolia*)	531
American bittersweet *(Celastrus scandens*)	455
American chestnut *(Castanea dentata*)	421
American cranberrybush *(Viburnum opulus var. americanum*)	777
American elm *(Ulmus americana*)	972
American hazelnut *(Corylus americana*)	501
American hogpeanut *(Amphicarpaea bracteata*)	448
American holly *(Ilex opaca*)	591
American hornbeam *(Carpinus caroliniana*)	391
American mountain ash *(Sorbus americana*)	935
American plum *(Prunus americana*)	766
American smoketree *(Cotinus obovatus*)	985
American sycamore *(Platanus occidentalis*)	731
American witchhazel *(Hamamelis virginiana*)	585
Apache pine *(Pinus engelmannii*)	112
apple *(Malus*)	660,661
arborvitae *(Thuja occidentalis*)	241
Arizona cypress *(Cupressus arizonica*)	51
Arizona pine *(Pinus arizonica*)	135
Arizona white oak *(Quercus arizonica*)	803
ash *(Fraxinus*)	540
Atlantic white cedar *(Chamaecyparis thyoides*)	43
Austrian pine *(Pinus nigra*)	133
autumn olive *(Elaeagnus umbellata*)	535

Species	FIA code
bald cypress *(Taxodium distichum*)	221
balsam fir *(Abies balsamea*)	12
balsam poplar *(Populus balsamifera*)	741
barberry *(Berberis*)	368
basswood *(Tilia*)	950
bastard oak *(Quercus sinuata var. sinuata*)	808
beaked hazelnut *(Corylus cornuta*)	502
bear oak *(Quercus ilicifolia*)	816
bigcone Douglas-fir *(Pseudotsuga macrocarpa*)	201
bigleaf magnolia *(Magnolia macrophylla*)	654
bigleaf maple *(Acer macrophyllum*)	312
bigtooth aspen *(Populus grandidentata*)	743
bigtooth maple *(Acer grandidentatum*)	322
birch *(Betula*)	370
birchleaf mountain mahogany *(Cercocarpus montanus var. glaber*)	478
Bishop pine *(Pinus muricata*)	120
bitter cherry *(Prunus emarginata*)	767
bitternut hickory *(Carya cordiformis*)	402
bittersweet *(Celastrus*)	454
black ash *(Fraxinus nigra*)	543
black cherry *(Prunus serotina*)	762
black cottonwood *(Populus balsamifera ssp. trichocarpa*)	747
black hickory *(Carya texana*)	408
black locust *(Robinia pseudoacacia*)	901
black maple *(Acer nigrum*)	314
black oak *(Quercus velutina*)	837
black spruce *(Picea mariana*)	95
black walnut *(Juglans nigra*)	602
black willow *(Salix nigra*)	922
blackberry *(Rubus*)	915
blackgum *(Nyssa sylvatica*)	693
blackhaw *(Viburnum prunifolium*)	776
blackjack oak *(Quercus marilandica*)	824
blue ash *(Fraxinus quadrangulata*)	546
blue oak *(Quercus douglasii*)	807
Blue Ridge blueberry *(Vaccinium pallidum*)	788
blue spruce *(Picea pungens*)	96
blueberry *(Vaccinium*)	786
bluejack oak *(Quercus incana*)	840
bog Labrador tea *(Ledum groenlandicum*)	608
bog rosemary *(Andromeda polifolia*)	357

Species	FIA code
border pinyon *(Pinus discolor*)	134
bottomland post oak *(Quercus similis*)	836
boxelder *(Acer negundo*)	313
Brewer spruce *(Picea breweriana*)	92
bristlecone fir *(Abies bracteata*)	14
bristlecone pine *(Pinus aristata*)	102
buckeye *(Aesculus*)	330, 333
buckthorn *(Rhamnus*)	845
bunchberry dogwood *(Cornus canadensis*)	498
bur oak *(Quercus macrocarpa*)	823
butternut *(Juglans cinerea*)	601
California black oak *(Quercus kelloggii*)	818
California buckeye *(Aesculus californica*)	334
California foothill pine *(Pinus sabiniana*)	127
California juniper *(Juniperus californica*)	62
California laurel *(Umbellularia californica*)	982
California live oak *(Quercus agrifolia*)	801
California nutmeg *(Torreya californica*)	251
California red fir *(Abies magnifica*)	20
California sycamore *(Platanus racemosa*)	732
California white oak *(Quercus lobata*)	821
Canada yew *(Taxus canadensis*)	232
Canadian plum *(Prunus nigra*)	765
canyon live oak *(Quercus chrysolepis*)	805
Carolina hemlock *(Tsuga caroliniana*)	262
catalpa *(Catalpa*)	450
catberry *(Nemopanthus mucronatus*)	685
cedar *(Chamaecyparis*)	40
cedar elm *(Ulmus crassifolia*)	973
cherrybark oak *(Quercus pagoda*)	813
chestnut oak *(Quercus prinus*)	832
Chihuahuan pine *(Pinus leiophylla*)	118
Chinaberrytree *(Melia azedarach*)	983
chinkapin *(Castanea pumila*)	422
chinkapin oak *(Quercus muehlenbergii*)	826
chinquapin *(Chrysolepis*)	430
chokeberry *(Photinia*)	365
chokecherry *(Prunus virginiana*)	763
common elderberry *(Sambucus nigra ssp. canadensis*)	927
common hackberry *(Celtis occidentalis*)	462
common juniper *(Juniperus communis*)	61

Species	FIA code
common ninebark *(Physocarpus opulifolius*)	725
common persimmon *(Diospyros virginiana*)	521
common pricklyash *(Zanthoxylum americanum*)	638
common sweetleaf *(Symplocos tinctoria*)	945
common winterberry *(Ilex verticillata*)	593
corkbark fir *(Abies lasiocarpa var. arizonica*)	18
cottonwood *(Populus*)	740
Coulter pine *(Pinus coulteri*)	109
creeping snowberry *(Symphoricarpos mollis*)	547
cucumber-tree *(Magnolia acuminata*)	651
curl-leaf mountain mahogany *(Cercocarpus ledifolius*)	475
currant *(Ribes*)	870
cypress *(Cupressus*)	50
deerberry *(Vaccinium stamineum*)	789
desert ironwood *(Olneya tesota*)	990
devil's walkingstick *(Aralia spinosa*)	343
Douglas-fir *(Pseudotsuga*)	200
Douglas-fir *(Pseudotsuga menziesii*)	202
eastern cottonwood *(Populus deltoides*)	742
eastern hemlock *(Tsuga canadensis*)	261
eastern leatherwood *(Dirca palustris*)	525
eastern poison ivy *(Toxicodendron radicans*)	867
eastern redbud *(Cercis canadensis*)	471
eastern redcedar *(Juniperus virginiana*)	68
eastern teaberry *(Gaultheria procumbens*)	548
eastern white pine *(Pinus strobus*)	129
elaeagnus *(Elaeagnus*)	534
elm *(Ulmus*)	970
Emory oak *(Quercus emoryi*)	810
Engelmann oak *(Quercus engelmannii*)	811
Engelmann spruce *(Picea engelmannii*)	93
European alder *(Alnus glutinosa*)	354
European larch *(Larix decidua*)	70
European mountain ash *(Sorbus aucuparia*)	936
farkleberry *(Vaccinium arboreum*)	981
fir *(Abies*)	10
fivestamen tamarisk *(Tamarix chinensis*)	946
flameleaf sumac *(Rhus copallinum*)	864
flowering dogwood *(Cornus florida*)	491
foxtail pine *(Pinus balfouriana*)	104
Fraser fir *(Abies fraseri*)	16

Species	FIA code
Fremont cottonwood *(Populus fremontii*)	748
Gambel oak *(Quercus gambelii*)	814
giant chinquapin *(Chrysolepis chrysophylla*)	431
giant sequoia *(Sequoiadendron giganteum*)	212
grand fir *(Abies grandis*)	17
grape *(Vitis*)	665
gray birch *(Betula populifolia*)	379
gray dogwood *(Cornus racemosa*)	496
green alder *(Alnus viridis*)	349
green ash *(Fraxinus pennsylvanica*)	544
greenbrier *(Smilax*)	934
gum *(Eucalyptus*)	510
gum bully *(Sideroxylon lanuginosum*)	381
hackberry *(Celtis*)	460
hairy mountain mahogany *(Cercocarpus montanus var. paucidentatus*)	477
hawthorn *(Crataegus*)	500
hemlock *(Tsuga*)	260
hickory *(Carya*)	400
hobblebush *(Viburnum lantanoides*)	772
holly *(Ilex*)	590
honeylocust *(Gleditsia triacanthos*)	552
honeysuckle *(Lonicera*)	635
hophornbeam *(Ostrya virginiana*)	701
huckleberry *(Gaylussacia*)	549
incense cedar *(Calocedrus decurrens*)	81
interior live oak *(Quercus wislizeni*)	839
jack pine *(Pinus banksiana*)	105
Japanese honeysuckle *(Lonicera japonica*)	636
Japanese larch *(Larix kaempferi*)	74
Jeffrey pine *(Pinus jeffreyi*)	116
juniper *(Juniperus*)	60
Kentucky coffeetree *(Gymnocladus dioicus*)	571
Kentucky yellowwood *(Cladrastis kentukea*)	481
kinnikinnick *(Arctostaphylos uva-ursi*)	363
knobcone pine *(Pinus attenuata*)	103
laurel oak *(Quercus laurifolia*)	820
leather flower *(Clematis*)	487
limber pine *(Pinus flexilis*)	113
littleleaf mountain mahogany *(Cercocarpus intricatus*)	479
live oak *(Quercus virginiana*)	838

Species	FIA code
loblolly bay *(Gordonia lasianthus*)	555
loblolly pine *(Pinus taeda*)	131
lodgepole pine *(Pinus contorta*)	108
longleaf pine *(Pinus palustris*)	121
lowbush blueberry *(Vaccinium angustifolium*)	785
madrone *(Arbutus*)	360
magnolia *(Magnolia*)	650
maple *(Acer*)	310
mapleleaf viburnum *(Viburnum acerifolium*)	771
mesquite *(Prosopis juliflora*)	755
mesquite *(Prosopis*)	986
Mexican blue oak *(Quercus oblongifolia*)	829
Missouri River willow *(Salix eriocephala*)	923
mockernut hickory *(Carya alba*)	409
Monterey pine *(Pinus radiata*)	124
mountain hemlock *(Tsuga mertensiana*)	264
mountain holly *(Ilex montana*)	592
mountain laurel *(Kalmia latifolia*)	606
mountain magnolia *(Magnolia fraseri*)	655
mountain maple *(Acer spicatum*)	319
mulberry *(Morus*)	680
nannyberry *(Viburnum lentago*)	775
narrowleaf cottonwood *(Populus angustifolia*)	749, 753
New Jersey tea *(Ceanothus americanus*)	458
New Mexico locust *(Robinia neomexicana*)	902
noble fir *(Abies procera*)	22
northern catalpa *(Catalpa speciosa*)	452
northern pin oak *(Quercus ellipsoidalis*)	809
northern red oak *(Quercus rubra*)	833
northern spicebush *(Lindera benzoin*)	609
Norway spruce *(Picea abies*)	91
oak *(Quercus*)	800, 850
Ogeechee tupelo *(Nyssa ogeche*)	692
Ohio buckeye *(Aesculus glabra*)	331
oneseed juniper *(Juniperus monosperma*)	69
Oregon ash *(Fraxinus latifolia*)	542
Oregon white oak *(Quercus garryana*)	815
oriental bittersweet *(Celastrus orbiculatus*)	456
osage orange *(Maclura pomifera*)	641
overcup oak *(Quercus lyrata*)	822
Ozark chinkapin *(Castanea pumila var. ozarkensis*)	423

Species	FIA code
Pacific dogwood *(Cornus nuttallii*)	495
Pacific madrone *(Arbutus menziesii*)	361
Pacific silver fir *(Abies amabilis*)	11
Pacific yew *(Taxus brevifolia*)	231
paper birch *(Betula papyrifera*)	375
partridgeberry *(Mitchella repens*)	675
pawpaw *(Asimina triloba*)	367
peachleaf willow *(Salix amygdaloides*)	921
pecan *(Carya illinoinensis*)	404
pignut hickory *(Carya glabra*)	403
pin cherry *(Prunus pensylvanica*)	761
pin oak *(Quercus palustris*)	830
Pinchot's juniper *(Juniperus pinchotii*)	58
pine *(Pinus*)	100, 170
pipsissewa *(Chimaphila umbellata*)	442
pitch pine *(Pinus rigida*)	126
plains cottonwood *(Populus deltoides ssp. monilifera*)	745
planertree *(Planera aquatica*)	984
plum *(Prunus*)	760, 764
poison sumac *(Toxicodendron vernix*)	868
pond cypress *(Taxodium ascendens*)	222
pond pine *(Pinus serotina*)	128
ponderosa pine *(Pinus ponderosa*)	122
Port Orford cedar *(Chamaecyparis lawsoniana*)	41
post oak *(Quercus stellata*)	835
princesstree *(Paulownia tomentosa*)	712
pumpkin ash *(Fraxinus profunda*)	545
quaking aspen *(Populus tremuloides*)	746
red alder *(Alnus rubra*)	351
red elderberry *(Sambucus racemosa*)	926
red maple *(Acer rubrum*)	316
red mulberry *(Morus rubra*)	682
red pine *(Pinus resinosa*)	125
red spruce *(Picea rubens*)	97
redbay *(Persea borbonia*)	721
redberry juniper *(Juniperus coahuilensis*)	59
redosier dogwood *(Cornus sericea ssp. sericea*)	497
redwood *(Sequoia sempervirens*)	211
rhododendron *(Rhododendron*)	366, 855
river birch *(Betula nigra*)	373
rock elm *(Ulmus thomasii*)	977

Species	FIA code
Rocky Mountain juniper *(Juniperus scopulorum*)	66
Rocky Mountain maple *(Acer glabrum*)	321
rose *(Rosa*)	905
roundleaf dogwood *(Cornus rugosa*)	494
Russian olive *(Elaeagnus angustifolia*)	536
sand pine *(Pinus clausa*)	107
sassafras *(Sassafras albidum*)	931
scarlet oak *(Quercus coccinea*)	806
Scotch pine *(Pinus sylvestris*)	130
scrub oak *(Quercus berberidifolia*)	899
September elm *(Ulmus serotina*)	976
serviceberry *(Amelanchier*)	355
shagbark hickory *(Carya ovata*)	407
Shasta red fir *(Abies ×shastensis*)	21
sheep laurel *(Kalmia angustifolia*)	605
shellbark hickory *(Carya laciniosa*)	405
shingle oak *(Quercus imbricaria*)	817
shortleaf pine *(Pinus echinata*)	110
Shumard's oak *(Quercus shumardii*)	834
Siberian elm *(Ulmus pumila*)	974
silky dogwood *(Cornus amomum*)	493
silver maple *(Acer saccharinum*)	317
silverbell *(Halesia*)	580
silverleaf oak *(Quercus hypoleucoides*)	843
singleleaf pinyon *(Pinus monophylla*)	136
Sitka spruce *(Picea sitchensis*)	98
slash pine *(Pinus elliottii*)	111
slippery elm *(Ulmus rubra*)	975
smooth sumac *(Rhus glabra*)	865
sourwood *(Oxydendrum arboreum*)	711
southern arrowwood *(Viburnum dentatum*)	774
southern catalpa *(Catalpa bignonioides*)	451
southern magnolia *(Magnolia grandiflora*)	652
southern mountain cranberry *(Vaccinium erythrocarpum*)	787
southern red oak *(Quercus falcata*)	812
southern redcedar *(Juniperus virginiana var. silicicola*)	67
southern sugar maple *(Acer barbatum*)	311
southwestern white pine *(Pinus strobiformis*)	114
speckled alder *(Alnus incana ssp. rugosa*)	353
spirea *(Spiraea*)	937
spruce *(Picea*)	90

Species	FIA code
spruce pine *(Pinus glabra*)	115
staghorn sumac *(Rhus hirta*)	866
striped maple *(Acer pensylvanicum*)	315
striped prince's pine *(Chimaphila maculata*)	441
subalpine fir *(Abies lasiocarpa*)	19
subalpine larch *(Larix lyallii*)	72
sugar maple *(Acer saccharum*)	318
sugar pine *(Pinus lambertiana*)	117
sugarberry *(Celtis laevigata*)	461
swamp chestnut oak *(Quercus michauxii*)	825
swamp cottonwood *(Populus heterophylla*)	744
swamp tupelo *(Nyssa biflora*)	694
swamp white oak *(Quercus bicolor*)	804
sweet birch *(Betula lenta*)	372
sweet fern *(Comptonia peregrina*)	485
sweetbay *(Magnolia virginiana*)	653
sweetgum *(Liquidambar styraciflua*)	611
sycamore *(Platanus*)	730
Table Mountain pine *(Pinus pungens*)	123
tallowtree *(Triadica sebifera*)	925
tamarack *(Larix laricina*)	71
tanoak *(Lithocarpus densiflorus*)	631
Texas red oak *(Quercus texana*)	828
tree of heaven *(Ailanthus altissima*)	341
tuliptree (also known as yellow-poplar and tulip-poplar) (*Liriodendron tulipifera*)	621
tungoil tree *(Vernicia fordii*)	980
tupelo *(Nyssa*)	690
turkey oak *(Quercus laevis*)	819
twoneedle pinyon *(Pinus edulis*)	106
unidentified commercial hardwood	4
unidentified commercial softwood	1
unidentified fern	995
unidentified fern	996
unidentified grass	993
unidentified herb	994
unidentified high value hardwood	5
unidentified high value softwood	2
unidentified moss	992
unidentified non-comm hardwood	6
unidentified non-comm softwood	3

Species	FIA code
unidentified shrub	998
unidentified species	999
unidentified tree	9
unidentified vine	997
Utah juniper *(Juniperus osteosperma*)	65
viburnum *(Viburnum*)	770
Virginia creeper *(Parthenocissus quinquefolia*)	715
Virginia pine *(Pinus virginiana*)	132
walnut *(Juglans*)	600
water birch *(Betula occidentalis*)	374
water hickory *(Carya aquatica*)	401
water locust *(Gleditsia aquatica*)	551
water oak *(Quercus nigra*)	827
water tupelo *(Nyssa aquatica*)	691
western hemlock *(Tsuga heterophylla*)	263
western juniper *(Juniperus occidentalis*)	64
western larch *(Larix occidentalis*)	73
western paper birch *(Betula papyrifera var. commutata*)	376
western red cedar *(Thuja plicata*)	242
western white pine *(Pinus monticola*)	119
white alder *(Alnus rhombifolia*)	352
white ash *(Fraxinus americana*)	541
white fir *(Abies concolor*)	15
white fringetree *(Chionanthus virginicus*)	474
white mulberry *(Morus alba*)	681
white oak *(Quercus alba*)	802
white poplar *(Populus alba*)	752
white spruce *(Picea glauca*)	94
whitebark pine *(Pinus albicaulis*)	101
willow *(Salix*)	920
willow oak *(Quercus phellos*)	831
winged elm *(Ulmus alata*)	971
withe-rod *(Viburnum nudum var. cassinoides*)	773
yellow birch *(Betula alleghaniensis*)	371
yellow buckeye *(Aesculus flava*)	332

Management Unit Variables

Management Unit Area Variable

Description: Total area of management unit.

Valid values: Management unit area must be greater than or equal to zero.
Units: Acres or hectares.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\text{MU Area} = \sum_{\text{stands}} \text{Stand Area}$$

Variables used in calculation: Stand Area.

Management Unit Variable - County

Description: County in which management unit is located.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the county in which the management unit occurs. If the unit crosses a county line, enter the county containing the largest portion of the property.
NED default value: None.
User-set default: Yes.
Calculated: No.

Management Unit Variable - Deer Impact

Description: Potential deer impact.

Valid values: Deer impact must be 0="unknown", 1="low", 2="low/med", 3="med", 4="med/high", or 5="high".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter an estimate of the amount of browsing pressure that deer are having, or likely to have, on tree seedlings in the management area. Codes are: 0 = unknown; 1 = low; 2 = low/medium; 3 = medium; 4 = medium/high; and 5 = high. Enter either the number or the word.
NED default value: Unknown.
User-set default: Yes.
Calculated: No.

Management Unit Variable - District

Description: District in which management unit is located.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. For public forests, enter the District name or number. For private forests, leave it blank or create your own code.
NED default value: None.
User-set default: Yes.
Calculated: No.

Management Unit Variable - Forest Name

Description: Name of forest where management unit is located.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. For public forests, enter the forest name. For private forests, leave it blank or create your own code.
NED default value: None.
User-set default: Yes.
Calculated: No.

Management Unit Variable - Land Type Association

Description: USDA Forest Service classification - land type association.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the USDA Forest Service land type association(s) according to Bailey's classification system (Bailey 1995).
NED default value: None.
User-set default: Yes.
Calculated: No.

Management Unit Variable - Name

Description: Name of management unit or property.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the name of the management unit or property.
NED default value: None.
User-set default: Yes.
Calculated: No.

Management Unit Variable - Owner

Description: Owner of management unit or property.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the owner's name.
NED default value: None.
User-set default: Yes.
Calculated: No.

Management Unit Variable - Roaded

Description: Truck road in or adjacent to the management unit.

Units: Yes/no.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

TRUE if any stand is found for which 'Roaded' = TRUE.

Variables used in calculation: Roaded.

Management Unit Variable - State

Description: State where management unit is located.

Valid values: State must be 1= "Alabama", 2="Alaska", 4="Arizona", 5="Arkansas", 6="California", 8="Colorado", 9="Connecticut", 10="Delaware", 11="District of Columbia", 12="Florida", 13="Georgia", 15="Hawaii", 16="Idaho", 17="Illinois", 18="Indiana", 19="Iowa", 20="Kansas", 21="Kentucky", 22="Louisiana", 23="Maine", 24="Maryland", 25="Massachusetts", 26="Michigan", 27="Minnesota", 28="Mississippi", 29="Missouri", 30="Montana", 31="Nebraska", 32="Nevada", 33="New Hampshire", 34="New Jersey", 35="New Mexico", 36="New York", 37="North Carolina", 38="North Dakota", 39="Ohio", 40="Oklahoma", 41="Oregon", 42="Pennsylvania", 44="Rhode Island", 45="South Carolina",

46=“South Dakota”, 47=“Tennessee”, 48=“Texas”, 49=“Utah”, 50=“Vermont”, 51=“Virginia”, 53=“Washington”, 54=“West Virginia”, 55=“Wisconsin”, 56=“Wyoming”, 60=“American Samoa”, 66=“Guam”, 72=“Puerto Rico”, or 78=“Virgin Islands”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter the state in which the management unit occurs. If the unit crosses a state line, enter the state containing the largest portion of the property.
NED default value: None.
User-set default: Yes.
Calculated: No.

Management Unit Variable - Number of Stands

Description: Number of stands on the management unit.

Valid values: Number of stands must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: No.
Tallied by user: No.
NED default value: 0.
User-set default: No.
Calculated: Yes.

Management Unit Number of Stands = count of stands in the Management Unit.

Management Unit Variable - Streams

Description: Presence of perennial stream within or adjacent to management unit.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. If streams are present within or immediately adjacent to the management unit, enter “present”; otherwise enter “absent.”
NED default value: None.
User-set default: Yes.
Calculated: Yes.

TRUE if Management Unit contains a stream.

Variables used in calculation: Stream Present.

Management Unit Variable - Knowledge Base for Prolog

Description: Name of knowledge base file for Prolog.

Units: Text.
Variable type: String.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Management Unit Variable - Water

Description: Open water is present on the management unit.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

Management Unit Water is TRUE if any stand has any of the following

‘Stream’ = TRUE;
‘Adjacent to water’ = TRUE;
‘Temporary ponds’ = TRUE;
‘Permanent ponds’ = TRUE;
‘Contains a wetland’ = TRUE;
‘Wetland’ = TRUE;
‘Contains a riparian’ = TRUE;
‘Riparian’ = TRUE.

Variables used in calculation: Riparian, Contains a Riparian, Wetland, Contains a Wetland, Permanent Ponds, Temporary Ponds, Adjacent to Water, Stream Present.

Stand Variables

Tallied Stand Variables

Stand Variable - Accessibility

Description: Type of vehicle access to stand.

Valid values: Accessibility must be 1=“2-wheel drive”, 2=“4-wheel drive”, 3=“within mi.”, or 4=“none”.

Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter the type of vehicle access to the stand. Enter the number of one of the following codes: 1 = two-wheel drive; 2 = four-wheel drive; 3 = within a mile of a road; 4 = none (no road access).
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Adjacent to Water

Description: Stand is adjacent to or contains a perennial stream, permanent pond, or lake.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "yes" if the stand is adjacent to or contains a perennial stream, permanent pond, or lake.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using stand - adjacent to water: Water

Stand Area Variable

Description: Area of stand.

Valid values: Stand area must be greater than zero.
Units: Acres or hectares.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the total acres and/or hectares in the stand.
NED default value: 1.0.
User-set default: Yes.
Calculated: No.

Other variables using stand area: Management Unit Area

Stand Variable - Aspect

Description: Average aspect of stand.

Valid values: Aspect must be between 0.0 and 360.0.
Units: Degrees.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the aspect of the stand either from a topographic map or while in the field. Enter as an azimuth reading from 0 to 360 degrees.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Caves

Description: Stand contains large openings in rocks that lead below frost line.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if there are any caves or larger rock openings that lead below the frost line.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Coarse Woody Debris in Water

Description: Coarse woody debris in water.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if any down logs within a minimum diameter of 6 inches are partially or wholly in a permanent water source.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Compartment

Description: Compartment where stand is located.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the compartment number and/or property name if applicable.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Land Cover Type

Description: Land cover type of stand.

Valid values: Land Cover Type must be 1="Urban and built-up land", 2="Agricultural land", 3="Brush or transitional between open and forested", 4="Forest", 5="Water", 6="Wetlands (not including open water; palustrine wetlands only)", 7="Barren land", 8="Tundra", 9="Permanent snow and ice", 11="Residential", 12="Commercial, Services & Institutional", 13="Industrial", 14="Transportation, Communication and Utilities", 15="Industrial/Commercial complexes", 16="Mixed urban or built-up land", 17="Other urban or built-up land", 21="Cropland and pasture", 210="Row crop", 211="Forage crop", 212="Pasture", 22="Orchards, bush fruits, vineyards, nurseries & ornamental horticulture", 23="Confined feeding operations", 24="Other agricultural land", 31="primarily herbaceous, non woody vegetation (<25% woody)", 32="primarily shrub/brush (>25% woody)", 33="low density trees (savanna)", 34="Savanna", 41="Broadleaf forest", 42="Coniferous forest", 43="Mixed Coniferous/Broadleaf forest", 51="Rivers, canals and other waterways", 52="Lakes and ponds", 53="Reservoirs (and other artificial water surfaces)", 54="Bays/Estuaries", 61="Aquatic bed", 62="Moss/Lichen (includes bogs and fens)", 63="Emergent wetland", 64="Scrub-Shrub wetland", 65="Forested wetland", 71="Salt flats", 72="Beaches and river banks", 73="Sandy areas (non-beaches)", 74="Bare/Exposed rock", 75="Strip mines, Quarries and Gravel pits", 76="Transitional", 77="Mixed barren land", 78="Mud flats", 81="Shrub and brush", 82="Herbaceous", 83="Bare Ground", 84="Wet", or 85="Mixed".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter the proper Level 1 or Level 2 Anderson et al. (1976) land cover type.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

If the 'Forest type' exists, the Land cover type will be determined as follows:

Forest Type	Land cover type
allegheny hardwoods	Broadleaf forest
appalachian hardwoods	Broadleaf forest
aspen	Broadleaf forest
aspen northern hardwoods	Broadleaf forest
aspen pine	Broadleaf forest
aspen spruce-fir	Broadleaf forest
aspen-birch	Broadleaf forest
bay-swamp pocosin	Forested wetland
beech magnolia	Broadleaf forest
beech-birch	Broadleaf forest
birch	Broadleaf forest
bottomland conifer	Coniferous forest
bottomland hardwoods	Forested wetland
bottomland mixed	Mixed Coniferous/Broadleaf forest
cedar	Coniferous forest
cherry	Broadleaf forest
Douglas-fir	Coniferous forest
Engelmann spruce - subalpine fir	Coniferous forest
fir	Coniferous forest
grand fir	Coniferous forest
hemlock	Coniferous forest
hemlock hardwoods	Mixed Coniferous/Broadleaf forest
hickory	Broadleaf forest
live oak maritime	Mixed Coniferous/Broadleaf forest
loblolly pine-shortleaf pine	Coniferous forest
lodgepole pine	Coniferous forest
longleaf pine	Coniferous forest
longleaf pine-scrub oak	Mixed Coniferous/Broadleaf forest
mangroves	Broadleaf forest
maple	Broadleaf forest
mesic mixed pine-hardwoods	Mixed Coniferous/Broadleaf forest
mesic mixed southern pine	Mixed Coniferous/Broadleaf forest

Forest Type	Land cover type
northern hardwoods	Broadleaf forest
oak	Broadleaf forest
oak bottomland hardwoods	Forest
oak northern hardwoods	Broadleaf forest
oak northern pine	Broadleaf forest
oak southern pine	Mixed Coniferous/Broadleaf forest
oak yellow poplar	Broadleaf forest
oak-hickory	Broadleaf forest
pine	Coniferous forest
pine hardwoods	Mixed Coniferous/Broadleaf forest
pine hemlock	Coniferous forest
plantation fir	Coniferous forest
plantation larch	Coniferous forest
plantation pine	Coniferous forest
plantation spruce	Coniferous forest
pond pine	Coniferous forest
pond pine pocosin	Forested wetland
ponderosa pine	Coniferous forest
sand pine	Coniferous forest
sand pine-southern scrub oak	Mixed Coniferous/Broadleaf forest
southern bottomland hardwoods	Forested wetland
southern mixed mesic hardwoods	Broadleaf forest
southern pine	Coniferous forest
southern scrub oak	Broadleaf forest
spruce	Coniferous forest
spruce-fir	Coniferous forest
spruce-northern hardwoods	Mixed Coniferous/Broadleaf forest
tropical hardwoods	Broadleaf forest
white pine-hemlock	Coniferous forest
xeric mixed pine-hardwoods	Mixed Coniferous/Broadleaf forest
xeric mixed southern pine	Coniferous forest
yellow poplar	Broadleaf forest
yellow poplar bottomland hardwoods	Broadleaf forest

Variables used in calculation: Forest Type

Other variables using stand - land cover type: Size Class

Stand Variable - Dead Cavity Tree

Description: Dead tree with cavity found in stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if at least one tree with a dead cavity occurs within the stand.

NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any overstory plot has 'Dead cavity tree' = TRUE

Variables used in calculation: Dead Cavity Tree Present

Stand Variable - Elevation

Description: Average elevation of stand.

Valid values: Elevation must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the average elevation in feet or meters for the stand from a topographic map.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Ecological Land Type

Description: Bailey's ecoregion code (ecological land type).

Units: ELT (ecological land type).
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter Bailey's ecological land type(s) in the stand (Bailey 1995).
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Features to Screen

Description: Features to screen.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. List any features that you would like to screen or hide such as a residence, a cut along a main road, a junk yard, etc.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Features to Show

Description: Features to show.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. List any features that you would like to show off such as a potential vista, a waterfall, an unusual looking tree, etc.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Forest Type

Description: Forest type.

Valid values: Forest Type must be 2=“other softwoods”, 5=“other hardwoods”, 8=“other mixedwoods”, 769=“allegheny hardwoods”, 629=“appalachian hardwoods”, 740=“aspen”, “aspen northern hardwoods”, “aspen pine”, “aspen spruce-fir”, 739=“aspen-birch”, “bay-swamp pocosin”, “beech magnolia”, 537=“beech-birch”, 370=“birch”, “bottomland conifer”, 579=“bottomland hardwoods”, “bottomland mixed”, 40=“cedar”, 760=“cherry”, 210=“Douglas-fir”, 206=“Engelmann spruce - subalpine fir”, 10=“fir”, 213=“grand fir”, 260=“hemlock”, 269=“hemlock hardwoods”, 400=“hickory”, “live oak maritime”, “loblolly pine-shortleaf pine”, 218=“lodgepole pine”, “longleaf pine”, “longleaf pine-scrub oak”, “mangroves”, 310=“maple”, 320=“maple-basswood”, “mesic mixed pine-hardwoods”, “mesic mixed southern pine”, 969=“northern hardwoods”, 800=“oak”, “oak bottomland hardwoods”, 849=“oak northern hardwoods”, “oak northern pine”, 860=“oak southern pine”, “oak yellow poplar”, 844=“oak-hickory”, 100=“pine”, 139=“pine hardwoods”, 162=“pine hemlock”, “plantation fir”, “plantation larch”, “plantation pine”, “plantation spruce”, “pond pine “, “pond pine pocosin”, 237=“ponderosa pine”, “sand pine”, “sand pine-southern scrub oak”, “southern bottomland hardwoods”, “southern mixed mesic hardwoods”, 170=“southern pine”, “southern scrub oak”, 90=“spruce”, 190=“spruce-fir”, 199=“spruce-northern hardwoods”, “tropical hardwoods”, “white pine-hemlock”, “xeric mixed pine-hardwoods”, “xeric mixed southern pine”, 620=“yellow poplar”, or “yellow poplar bottomland hardwoods”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate code for the forest type that most closely matches the current overstory species composition of your stand.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

Calculated using the NED forest type algorithm. (See the topic on calculation of forest types for more information. You can run the NED Forest Type program within NED-2 from the Tools Menu to see how forest type is being calculated.

Variables used in calculation: Stems Per Unit Area, Basal Area, Species

Other variables using stand - forest type: Land Cover Type

Stand Variable - Average Haul Distance

Description: Average haul distance.

Valid values: Average haul distance must be greater than or equal to zero.
Units: Miles or kilometers.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the average distance from the stand to the nearest mill.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Height to Bottom of Canopy

Description: Height to lowest leaves that form the overstory canopy.

Valid values: Height to bottom of canopy must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the distance from the ground to the bottom of the overstory canopy.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - High Perch

Description: High perches in stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if any high exposed perches occur in the stand. A high perch is any live or dead tree that clearly towers above the canopy such as a supercanopy white pine, or a single tree or group of trees standing above ground vegetation such as a lone elm in a pasture or a snag in a clearcut.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Live Cavity Tree

Description: Live tree with cavity found in stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if at least one tree with a live cavity occurs within the stand.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any overstory plot has 'Live Cavity Tree' = TRUE.

Variables used in calculation: Live Cavity Tree Present

Stand Variable - Loose Soils

Description: Stand contains soil that is easily burrowed into.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if there is soil that can be easily burrowed into.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Low Perch

Description: Low perches in stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if any low exposed perches occur in the stand. Low perches are any exposed perches less than 10 ft high. Examples include fences, isolated shrubs, clumps of woody sprouts, tree tops remaining after harvesting, and short tree stubs.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Operability

Description: Subjective estimate of site operability.

Valid values: Operability must be 1=”no limitations” or 2=”limited”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. An estimate of the stand’s environmental or economic limitations such as unmarketable timber or wet soils, steep slopes, or rockiness that limit the use of mechanical equipment. Enter “2” if steep slope, rockiness, or poor drainage limit the use of mechanical equipment. Enter “1” if no such limitations exist.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Permanent Ponds

Description: Presence of permanent pond within or adjacent to stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if any permanent ponds or lakes are within or adjacent to the stand. Permanent ponds are any size or depth, but larger is generally better; water must be present year-round, although the top layer can freeze.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using stand - permanent ponds: Water

Stand Variable - Percent Area Riparian

Description: Percent of stand in riparian area (includes buffer strip).

Valid values: Percent area riparian must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the stand area that falls within a riparian area and include buffer strips along water sources. Riparian areas include stream channels, lakes, wetlands, floodplains, and immediately adjacent terrestrial ecosystems.
NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Other variables using stand - percent area riparian: Wetland, Riparian, Contains a Riparian

Stand Variable - Percent Area Wetland

Description: Percent area of stand in wetland.

Valid values: Percent area wetland must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the stand area that falls within a wetland. Wetlands include areas with shallow standing water or seasonal to year-long saturated soils (including bogs, marshes, and wet meadows).
NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Other variables using stand - percent area wetland: Wetland, Contains a Wetland

Stand Variable - Slope

Description: Average percent slope of stand.

Valid values: Slope must be greater than or equal to zero.
Units: Percent.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the average percent slope for the stand.
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using stand - slope: Slopes >30%

Stand Variable - Stream Present

Description: Presence of perennial stream within or adjacent to stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if perennial streams are within the stand or immediately adjacent to the stand.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using stand - stream present: Riparian, Streams, Water

Stand Variable - Pre-inventory Treatment Year

Description: Year of last treatment before inventory.

Valid values: Pre-inventory treatment year must be greater than or equal to zero.
Units: Year.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the year of last treatment prior to the inventory year.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Rock Crevices

Description: Stand contains openings in rocks that lead below frost line.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if there are openings in the rocks that lead below the frost line.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Rock Piles

Description: Stand contains rock piles or stone walls.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if there are any natural or manmade piles (rock walls), as long as they provide hiding places for small mammals, amphibians, or reptiles.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Seeps

Description: Presence of seeps in stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” or “absent” as to the presence of seeps or springs within or adjacent to the stand. A seep is a source of surface groundwater without a well defined point of origin. A spring has a well defined point of origin. Seeps and springs may or may not have vegetation around them.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Site Index

Description: Site index of stand.

Valid values: Site Index must be greater than or equal to zero.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the site index number as determined from appropriate charts; record to the nearest index, do not round the numbers. Site index should be calculated from age and height measurements of 3 to 10 dominant or codominant trees of the site species. Do not bore veneer quality trees. Site index affects growth potential of trees, and in NED-2 is used to affect growth rates when running simulations. In the eastern United States, site index is typically estimated as the expected height of a dominant tree at age 50.
NED default value: 60.
User-set default: Yes.
Calculated: No.

Stand Variable - Site Index Species

Description: Species used in the site index determination.

Units: Symbol.
Variable type: Species.

Editable by user: Yes.
Tallied by user: Yes. Enter the tree species for which the site index was determined. You may use any of the accepted codes for species identification, including the USDA PLANTS Database symbol, the three-digit FIA code, or your user code. See the topic on recording plant species for more information.
NED default value: None.
User-set default: No.
Calculated: Yes.

Calculated as the species with the highest basal area in overstory observations of the inventory.

Variables used in calculation: Basal Area

Stand Variable - Slope Shape

Description: Ocular estimate of the horizontal slope shape perpendicular to the slope (parallel to the contour).

Valid values: Slope shape must be 1="Convex", 2="Linear", or 3="Concave".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter the most applicable slope shape from the following codes: 1 = convex, 2 = linear, or 3 = concave.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand ID Variable

Description: Stand identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the stand identification name or number.
NED default value: ID.
User-set default: Yes.
Calculated: Yes.

Calculated as the concatenation of the string "Stand" with the value of STAND + 1.

Stand Variable - Temporary Ponds

Description: Presence of temporary or vernal ponds within or adjacent to stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if any temporary or vernal ponds are within or adjacent to the stand. Temporary ponds must be greater than 6 inches deep and greater than 1 square yard; water must be present for at least two months during the growing season. The exact month differs for each species that uses temporary ponds. Areas covered by a fine layer of silt and depressions filled with blackened leaves may serve as dry season indicators of temporary ponds.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using stand - temporary ponds: Water

Stand Variable - Topographic Position

Description: Topographic position of this stand.

Valid values: Topographic position must be 1=“upland plateau”, 2=“upland bottom”, 3=“ridge top”, 4=“upper slope or shoulder”, 5=“midslope”, 6=“bench”, 7=“lower slope”, or 8=“bottomland, flatland”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter the topographic position of the stand from the following codes: 1 = upland plateau, 2 = upland bottom, 3 = ridge top, 4 = upper slope or shoulder, 5 = midslope, 6 = bench, 7 = lower slope, or 8 = bottomland, flatland.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Roaded

Description: Truck road in or adjacent to the stand.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if there is a truck road in or adjacent to the stand.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using stand - roaded: Roaded

Stand Variable - Unique Features

Description: Description of unique feature.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter a description of the unique feature.
NED default value: None.
User-set default: Yes.
Calculated: No.

Stand Variable - Year of Origin

Description: Year of stand origin.

Valid values: Year of origin must be greater than or equal to zero.
Units: Year.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. If the stand is even-age, enter the year the stand originated. This is determined either by coring representative site index trees or using the program's calculated effective age to determine year of origin.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

Calculated as Snapshot year minus effective age.

Variables used in calculation: Effective Age, Snapshot year

Biomass Variables

Stand Variable - Aboveground Biomass

Description: Aboveground dry-weight biomass.

Valid values: Aboveground biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\sum_{\text{overstory plots}}\frac{\text{Aboveground biomass}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\sum_{\text{understory plots}}\frac{\text{Aboveground biomass}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Variables used in calculation: Understory Plot Aboveground Biomass, Overstory Plot Aboveground Biomass

Stand Variable - Branch Biomass

Description: Branch dry-weight biomass.

Valid values: Branch biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Branch biomass}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{understory}\\\text{plots}}}\frac{\text{Branch biomass}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Variables used in calculation: Understory Plot Branch Biomass, Overstory Plot Branch Biomass

Stand Variable - Coarse Root Biomass

Description: Coarse root dry-weight biomass.

Valid values: Coarse root biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Coarse root biomass}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{understory}\\\text{plots}}}\frac{\text{Coarse root biomass}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Variables used in calculation: Overstory Plot Coarse Root Biomass, Understory Plot Coarse Root Biomass

Stand Variable - Foliage Biomass

Description: Foliage dry-weight biomass.

Valid values: Foliage Biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}}\left(\sum_{\substack{\text{overstory}\\ \text{plots}}}\frac{\text{Foliage biomass}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\substack{\text{plot}\\ \text{clusters}}}\left(\sum_{\substack{\text{understory}\\ \text{plots}}}\frac{\text{Foliage biomass}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Variables used in calculation: Understory Plot Foliage Biomass, Overstory Plot Foliage Biomass

Stand Variable - Stem Bark Biomass

Description: Stem bark dry-weight biomass.

Valid values: Stem bark biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}}\left(\sum_{\substack{\text{overstory}\\ \text{plots}}}\frac{\text{Stem bark biomass}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\substack{\text{plot}\\ \text{clusters}}}\left(\sum_{\substack{\text{understory}\\ \text{plots}}}\frac{\text{Stem bark biomass}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Variables used in calculation: Overstory Plot Stem Bark Biomass, Understory Plot Stem Bark Biomass

Stand Variable - Stem Wood Biomass

Description: Stem wood dry-weight biomass.

Valid values: Stem wood biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Stem wood biomass}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{understory}\\\text{plots}}}\frac{\text{Stem wood biomass}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Variables used in calculation: Overstory Plot Stem Wood Biomass, Understory Plot Stem Wood Biomass

Stand Variable - Total Biomass

Description: Total dry-weight biomass.

Valid values: Total biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Total biomass}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{understory}\\\text{plots}}}\frac{\text{Total biomass}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Variables used in calculation: Understory Plot Total Biomass, Overstory Plot Total Biomass

Composition and Structure and Age Variables

Stand Variable - Average Shrub Layer Height

Description: Average height of plants between 3 and 10 feet.

Valid values: Average shrub layer height must be between 3 and 10 feet.
Units: Feet or meters.
Variable type: Float.

Editable by user: No.

Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \text{Average shrub layer height}}{\text{count of plot clusters where the 'Average shrub layer height' has a valid value}}$$

Variables used in calculation: Average Shrub Layer Height

Stand Variable - Canopy Closure

Description: Percent canopy closure.

Valid values: Canopy closure must be between 0 and 100.
Units: Percent closure.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\frac{\sum_{\substack{\text{overstory}\\ \text{plots}}} \text{Canopy closure}}{\text{Overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Canopy Closure

Stand Variable - Coarse Woody Debris

Description: Coarse woody debris in stand.

Valid values: Coarse Woody Debris must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\pi^2 \times \left(\sum_{\text{transects}} \sum_{\substack{\text{dead/down} \\ \text{observations}}} \text{Count} \times \text{Diameter}^2 \right)}{8 \times \sum_{\text{transects}} \text{Transect length}} \times \frac{43560 \ \ ^{\text{sq ft}}/_{\text{acre}}}{144 \ \ ^{\text{sq in}}/_{\text{sq ft}}}$$

Variables used in calculation: Volume

Stand Variable - Effective Age

Description: Age estimated from size and species of trees in stand.

Valid values: Effective age must be greater than or equal to zero.
Units: Years.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\dfrac{\sum_{\substack{\text{plot} \\ \text{clusters}}} \left(\dfrac{\sum_{\substack{\text{overstory} \\ \text{plots}}} \sum_{\substack{\text{tree} \\ \text{observations}}} \text{dbh}^3 \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots} \times \text{growth factor}} + \dfrac{\sum_{\substack{\text{plot} \\ \text{clusters}}} \left(\dfrac{\sum_{\substack{\text{understory} \\ \text{plots}}} \sum_{\substack{\text{understory} \\ \text{observations}}} \text{dbh}^3 \times \text{Stems per unit area}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots} \times \text{growth factor}}}{\dfrac{\sum_{\substack{\text{plot} \\ \text{clusters}}} \left(\dfrac{\sum_{\substack{\text{overstory} \\ \text{plots}}} \sum_{\substack{\text{tree} \\ \text{observations}}} \text{dbh}^2 \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}} + \dfrac{\sum_{\substack{\text{plot} \\ \text{clusters}}} \left(\dfrac{\sum_{\substack{\text{understory} \\ \text{plots}}} \sum_{\substack{\text{understory} \\ \text{observations}}} \text{dbh}^2 \times \text{Stems per unit area}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}}}$$

where:
growth factor = 0.20 if Species is one of the following:
"ACRU" (red maple)
"FRAM2" (white ash)
"LITU" (tuliptree)
"MAAC" (cucumber-tree)
"PRSE2" (black cherry)
"QURU" (northern red oak)
"TIAM" (American basswood)
growth factor = 0.15 if Species is not listed above

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh > 5.5

Variables used in calculation: Tree Observation Species, DBH, Stems Per Unit Area, Growth Form, Understory Observation Species

Other variables using stand - effective age: Year of Origin, Pulpwood Height

Stand Variable - Exotics

Description: Exotic plant species present on stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

Calculated as TRUE if any plot cluster has 'Exotics' = TRUE.

Variables used in calculation: Exotic Plants Present

Stand Variable - Number of Big Trees Per Unit Area

Description: Number of big trees per unit area in stand.

Valid values: Number of big trees per unit area must be greater than or equal to zero.
Units: Stems per acre or stems per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Only use observations where dbh ≥ 'Big tree dbh threshold'
Only use observations where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where 'Living' is TRUE

Variables used in calculation: Big Tree DBH Threshold, DBH, Stems Per Unit Area, Species, Growth Form

Stand Variable - Number of Plot Size Classes

Description: Number of plot size classes.

Valid values: Number of Plot Size Classes must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Calculated by counting the number of different values for 'Plot size class'.

Variables used in calculation: Plot Size Class

Stand Variable - Total Midstory

Description: Average midstory percent cover.

Valid values: Total midstory must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Midstory closure}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Stand Variable - Coniferous Midstory

Description: Average midstory percent cover of coniferous species.

Valid values: Coniferous midstory must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.

User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Midstory closure}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

only use overstory plots where 'Midstory type' = "coniferous"

Variables used in calculation: Midstory Closure, Midstory Type

Stand Variable - Deciduous Midstory

Description: Average midstory percent cover of deciduous species.

Valid values: Deciduous Midstory must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Midstory closure}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

only use overstory plots where 'Midstory type' = "deciduous"

Variables used in calculation: Midstory Closure, Midstory Type

Stand Variable - Mixed Midstory

Description: Average midstory percent cover of mixed species.

Valid values: Mixed midstory must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Midstory closure}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

only use overstory plots where 'Midstory type' = "mixed"

Variables used in calculation: Midstory Closure, Midstory Type

Stand Variable - Ground Layer Percent Cover

Description: Percent cover of foliage less than 3 feet in height.

Valid values: Ground layer percent cover must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \text{Percent ground cover}}{\text{count of Plot clusters with ground plots}}$$

Variables used in calculation: Percent Ground Cover

Stand Variable - Shrub Layer Percent Cover

Description: Percent cover of foliage between 3 and 10 feet in height.

Valid values: Shrub layer percent cover must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \text{Shrub layer percent cover}}{\text{count of Plot clusters with understory or ground plots}}$$

Variables used in calculation: Shrub Layer Percent Cover

Stand Variable - Percent Plots in Large Sawtimber

Description: Percent of plots in large sawtimber size class.

Valid values: Percent plots in large sawtimber must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of overstory plots where 'Plot size class' = "large sawtimber"}}{\text{overstory plot count}}\right) \times 100$$

Variables used in calculation: Plot Size Class

Stand Variable - Percent Open Plots

Description: Percent of plots in openings.

Valid values: Percent open plots must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of open overstory plots}}{\text{overstory plot count}}\right) \times 100$$

where: an open overstory plot is one where:
'Plot size class' = "regeneration"
OR
'Canopy closure' < 20.0

Variables used in calculation: Canopy Closure, Plot Size Class

Stand Variable - Percent Plots in Pole Size Class

Description: Percent of plots in pole size class.

Valid values: Percent plots in pole size class must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of overstory plots where 'Plot size class' = "pole"}}{\text{overstory plot count}}\right) \times 100$$

Variables used in calculation: Plot Size Class

Stand Variable - Percent Plots in Regeneration

Description: Percent of plots in regeneration size class.

Valid values: Percent plots in regeneration must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of overstory plots where 'Plot size class' = "regeneration"}}{\text{overstory plot count}}\right) \times 100$$

Variables used in calculation: Plot Size Class

Stand Variable - Percent Plots in Sapling

Description: Percent of plots in sapling size class.

Valid values: Percent plots in sapling must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of overstory plots where 'Plot size class' = "sapling"}}{\text{overstory plot count}}\right)\times 100$$

Variables used in calculation: Plot Size Class

Stand Variable - Percent Plots in Small Sawtimber

Description: Percent of plots in small sawtimber size class.

Valid values: Percent plots in small sawtimber must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of overstory plots where 'Plot size class' = "small sawtimber"}}{\text{overstory plot count}}\right)\times 100$$

Variables used in calculation: Plot Size Class

Stand Variable - High Slash

Description: Percent of plots with high slash.

Valid values: High slash must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of Plot clusters where any transect has 'High slash' = TRUE}}{\text{count of Plot Clusters with transects}}\right)\times 100$$

Variables used in calculation: High Slash

Stand Variable - Low Slash

Description: Percent of plots with low slash.

Valid values: Low slash must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of Plot clusters where any transect has 'Low slash' = TRUE}}{\text{count of Plot Clusters with transects}}\right)\times 100$$

Variables used in calculation: Low Slash Piles Present

Stand Variable - Coniferous Shrub Layer

Description: Percent of plot clusters with coniferous species between 3 and 10 feet in height.

Valid values: Coniferous shrub layer must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count plot clusters where 'Coniferous shrub' = TRUE}}{\text{count of Plot clusters with understory or ground plots}}\right)\times 100$$

Variables used in calculation: Coniferous Shrub Layer

Stand Variable - Deciduous Shrub Layer

Description: Percent of plot clusters with deciduous species between 3 and 10 feet in height.

Valid values: Deciduous shrub layer must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count plot clusters where 'Deciduous shrub' = TRUE}}{\text{count of Plot clusters with understory or ground plots}}\right) \times 100$$

Variables used in calculation: Deciduous Shrub Layer

Stand Variable - Ericaceous Shrub Layer

Description: Percent of plot clusters with ericaceous between 3 and 10 feet in height.

Valid values: Ericaceous shrub layer must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count plot clusters where 'Ericaceous shrub' = TRUE}}{\text{count of Plot clusters with understory or ground plots}}\right) \times 100$$

Variables used in calculation: Ericaceous Shrub Layer

Stand Variable - Rare

Description: Rare plant species present on stand.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

Calculated as TRUE if any plot cluster has ‘Rare’=TRUE.

Variables used in calculation: Rare Plants Present

Stand Variable - Stems Per Unit Area in Saplings

Description: Number of sapling size trees per unit area in stand.

Valid values: Stems per unit area in saplings must be greater than or equal to zero.
Units: Stems per acre or stems per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where $1.0 \leq \text{dbh} \leq 5.5$

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH, Include Dead Trees in Timber Values, Living

Stand Variable - Stems Per Unit Area in Seedlings

Description: Number of seedling size trees per unit area in stand.

Valid values: Stems per unit area in seedlings must be greater than or equal to zero.
Units: Stems per acre or stems per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh < 1.0

Variables used in calculation: Tree Observation DBH, Understory Observation Stems Per Unit Area, Tree Observation Stems Per Unit Area, Understory Observation DBH, Include Dead Trees in Timber Values, Living

Stand Variable - Size Class

Description: Stand size class.

Valid values: Size class must be 1="regeneration", 2="sapling", 3="pole", 4="small sawtimber", 5="large sawtimber", or 6="non-forested".
Units: Code.
Variable type: Category.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'Land cover type' is not one of the following:
"Forest"
"Broadleaf forest"
"Coniferous forest"
"Mixed Coniferous/Broadleaf forest"
"Forested wetland"
Size class = "non forested"
ELSE IF (Medial dbh < 1.0)
Size class = "regeneration"
ELSE IF (1.0 ≤ Medial dbh ≤ 4.5)
Size class = "sapling"
ELSE IF (4.5 < Medial dbh ≤ 10.5)
Size class = "pole"
ELSE IF (10.5 < Medial dbh ≤ 16.5)
Size class = "small sawtimber"
ELSE IF (16.5 < Medial dbh)
Size class = "large sawtimber"

Variables used in calculation: Medial DBH, Land Cover Type

Stand Variable - Old Growth

Description: Stand is an old growth area.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Stand Variable - Stems Per Unit Area

Description: Number of trees per unit area in stand.

Valid values: Stems per unit area must be greater than or equal to zero.
Units: Stems per acre or stems per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh ≥ 1.0

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH, Living, Include Dead Trees in Timber Values

Stand Variable - Year of Maturity

Description: Estimated year of maturity.

Units: Year.
Variable type: Integer.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\text{Snapshot year} + \frac{18.0 - \text{Merchantable medial dbh}}{\left(\frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{overstory plots}} \sum_{\text{tree observations}} \text{Basal area} \times \text{Stems per unit area} \times \text{growth factor}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{understory plots}} \sum_{\text{understory observations}} \text{Basal area} \times \text{Stems per unit area} \times \text{growth factor}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}} \right)}{\left(\frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{overstory plots}} \sum_{\text{tree observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{understory plots}} \sum_{\text{understory observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}} \right)}$$

where:
growth factor = 0.20 if Species is one of the following:
"ACRU" (red maple)
"FRAM2" (white ash)
"LITU" (tuliptree)
"MAAC" (cucumber-tree)
"PRSE2" (black cherry)
"QURU" (northern red oak)
"TIAM" (American basswood)
growth factor = 0.15 if Species is not listed above

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh > 5.5

Variables used in calculation: Merchantable Medial DBH, Basal Area, DBH, Species, Snapshot Year, Growth Form

Diameter Variables and Q Factor

Stand Variable - Average DBH

Description: Average (arithmetic mean) dbh of trees in stand.

Valid values: Average dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{dbh} \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{dbh} \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh ≥ 1.0

Variables used in calculation: Tree Observation DBH, Tree Observation Stems Per Unit Area, Growth Form, Understory Observation Stems Per Unit Area, Understory Observation DBH

Stand Variable - Medial DBH

Description: Medial dbh of trees in stand.

Valid values: Medial dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{dbh}^3\times\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}+\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{dbh}^3\times\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{dbh}^2\times\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}+\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{dbh}^2\times\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh ≥ 1.0

Variables used in calculation: Tree Observation DBH, Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Growth Form

Other variables using stand - medial dbh: Size Class

Stand Variable - Merchantable Medial DBH

Description: Medial dbh of merchantable trees in stand.

Valid values: Merchantable medial dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}} \text{dbh}^3 \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}} \text{dbh}^3 \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}} \text{dbh}^2 \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}} \text{dbh}^2 \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh > 5.5

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH, Growth Form

Other variables using stand - merchantable medial dbh: Year of Maturity

Stand Variable - Q Factor

Description: Q factor.

Valid values: Q Factor must be greater than or equal to zero.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$10^{-(\text{'Size class interval used for computing q factor'} \times \text{slope of regression})}$$

'Size class interval used for computing q factor' is set using the "Calculation settings" dialog in the Enter/Edit Inventory module.

The 'slope of regression' is determined by a least squares regression of the log of the 'Stems per unit area' by diameter size class. Observations less than 1 inch are ignored. Plots or clusters without valid tree observations are ignored.

see:
http://oak.snr.missouri.edu/silviculture/mosilviculture/q.html

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH, Size Class Interval Used for Computing Q Factor, Growth Form

Stand Variable - Quadratic Mean DBH

Description: Quadratic mean dbh of trees in stand.

Valid values: Quadratic mean dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sqrt{\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{dbh}^2 \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{dbh}^2 \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}}{\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}}$$

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh ≥ 1.0

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH, Growth Form

Stand Variable - Merchantable Quadratic Mean DBH

Description: Quadratic dbh of merchantable trees in stand.

Valid values: Merchantable quadratic mean dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sqrt{\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{dbh}^2 \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{dbh}^2 \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}}{\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}}}$$

IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE
Only calculated where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where dbh > 5.5

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH, Growth Form

Mast Variables

Stand Variable - Ground Layer with Fruits and Nuts

Description: Percent cover of species in the ground layer < 3 feet in height with fruits and nuts.

Valid values: Ground layer with fruits and nuts must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\text{Ground layer with fruits and nuts}}{\text{count of Plot clusters with ground plots}}$$

Variables used in calculation: Ground Layer with Fruits and Nuts

Stand Variable - Shrub Layer with Fruits and Nuts

Description: Percent cover of species in the shrub layer between 3 and 10 feet in height with fruits and nuts.

Valid values: Shrub Layer with fruits and nuts must be between 0 and 100.

Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \text{Shrub layer with fruits and nuts}}{\text{count of Plot clusters with understory or ground plots}}$$

Variables used in calculation: Shrub Layer with Fruits and Nuts

Stand Variable - Hard Mast

Description: Percent clusters with hard mast species.

Valid values: Hard mast must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of plot clusters where 'Hard mast' is TRUE}}{\text{count of Plot clusters with overstory, understory or ground plots}}\right) \times 100$$

Variables used in calculation: Hard Mast Present

Stand Variable - Soft Mast

Description: Percent clusters with soft mast species.

Valid values: Soft mast must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.

User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of plot clusters where 'Soft mast' is TRUE}}{\text{count of Plot clusters with overstory, understory or ground plots}}\right)\times 100$$

Variables used in calculation: Soft Mast

Regeneration Variables

Stand Variable - Percent Plots Stocked with Commercial Regeneration

Description: Percent of plots stocked with commercial regeneration.

Valid values: Percent plots stocked with commercial regeneration must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Count of plot clusters where 'Stocked with commercial regen' = TRUE}}{\text{count of Plot clusters with understory or ground plots}}$$

Variables used in calculation: Stocked with Commercial Regen.

Stand Variable - Percent Plots Stocked with High Value Regeneration

Description: Percent of plots stocked with high value regeneration.

Valid values: Percent plots stocked with high value regeneration must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Count of plot clusters where 'Stocked with high value regen' = TRUE}}{\text{count of Plot clusters with understory or ground plots}}$$

Variables used in calculation: Stocked with High Value Regen.

Stand Variable - Understory Percent Regeneration Sprout

Description: Average percent regeneration from sprout origin on the understory plots.

Valid values: Understory percent regeneration sprout must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{understory plots}} \text{Percent regen sprout}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}}$$

Variables used in calculation: Percent Regen Sprout

Site Variables

Stand Variable - Litter Depth

Description: Depth of litter.

Valid values: Litter depth must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}} \text{Litter depth}}{\text{count of Plot clusters with ground plots}}$$

Variables used in calculation: Litter Depth

Stand Variable - Percent Cover Rock

Description: Percent cover of bare rock or stone.

Valid values: Percent cover rock must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}}\left(\frac{\sum_{\substack{\text{ground}\\ \text{plots}}}\text{Percent rock}}{\text{ground plot count}}\right)}{\text{count of Plot clusters with ground plots}}$$

Variables used in calculation: Percent Rock

Stand Variable - Percent Cover of Leaf Litter

Description: Percent cover of leaf litter.

Valid values: Percent cover of leaf litter must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}}\left(\frac{\sum_{\substack{\text{ground}\\ \text{plots}}}\text{Percent litter}}{\text{ground plot count}}\right)}{\text{count of Plot clusters with ground plots}}$$

Variables used in calculation: Percent Litter

Stand Variable - Contains a Riparian

Description: Stand contains a riparian area.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

'Contains a riparian' is TRUE if:

$$20 \leq \text{Percent area riparian} \leq 50$$

OR

$$\left(\left(\frac{\text{count of ground plots where 'Riparian plot' = TRUE}}{\text{ground plot count}}\right) \times 100\right) < 50$$

AND (count of ground plots where 'Riparian plot' = TRUE) ≥ 2

OR

$$\left(\left(\frac{\text{count of understory plots where 'Riparian plot' = TRUE}}{\text{understory plot count}}\right) \times 100\right) < 50$$

AND (count of understory plots where 'Riparian plot' = TRUE) ≥ 2

OR

$$\left(\left(\frac{\text{count of overstory plots where 'Riparian plot' = TRUE}}{\text{overstory plot count}}\right) \times 100\right) < 50$$

AND (count of overstory plots where 'Riparian plot' = TRUE) ≥ 2

Variables used in calculation: Overstory Plot Riparian Plot, Understory Plot Riparian Plot, Ground Plot Riparian Plot, Percent Area Riparian

Other variables using stand - contains a riparian: Contains a Wetland, Water

Stand Variable - Riparian

Description: Stand is a riparian area.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.

User-set default: No.
Calculated: Yes.

'Riparian' is TRUE if:

'Percent area riparian' > 50

OR

'Stream' = TRUE

OR

$$\left(\left(\frac{\text{count of ground plots where 'Riparian plot' = TRUE}}{\text{ground plot count}}\right)\times 100\right)\geq 50$$

OR

$$\left(\left(\frac{\text{count of understory plots where 'Riparian plot' = TRUE}}{\text{understory plot count}}\right)\times 100\right)\geq 50$$

OR

$$\left(\left(\frac{\text{count of overstory plots where 'Riparian plot' = TRUE}}{\text{overstory plot count}}\right)\times 100\right)\geq 50$$

Variables used in calculation: Understory Plot Riparian Plot, Ground Plot Riparian Plot, Stream Present, Percent Area Riparian, Overstory Plot Riparian Plot

Other variables using stand - riparian: Water

Stand Variable - Wetland

Description: Stand is a wetland.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

'Wetland' is TRUE if:

'Percent area riparian' > 50

OR

'Percent area wetland' > 50

OR

$$\left(\frac{\text{count of ground plots where 'Wetland vegetation' = TRUE}}{\text{ground plot count}} \times 100\right) \geq 50$$

OR

$$\left(\frac{\text{count of understory plots where 'Wetland vegetation' = TRUE}}{\text{understory plot count}} \times 100\right) \geq 50$$

OR

$$\left(\left(\frac{\text{count of ground plots where 'Riparian plot' = TRUE}}{\text{ground plot count}}\right) \times 100\right) \geq 50$$

OR

$$\left(\left(\frac{\text{count of understory plots where 'Riparian plot' = TRUE}}{\text{understory plot count}}\right) \times 100\right) \geq 50$$

OR

$$\left(\left(\frac{\text{count of overstory plots where 'Riparian plot' = TRUE}}{\text{overstory plot count}}\right) \times 100\right) \geq 50$$

Variables used in calculation: Understory Plot Riparian Plot, Ground Plot Riparian Plot, Understory Plot Wetland Vegetation, Ground Plot Wetland Vegetation, Percent Area Wetland, Percent Area Riparian

Other variables using stand - wetland: Water

Stand Variable - Contains a Wetland

Description: Stand contains a wetland area.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

'Contains a wetland' is TRUE if:

Contains a riparian = TRUE

OR

$20 \leq$ Percent area wetland ≤ 50

OR

$$\left(\frac{\text{count of ground plots where 'Wetland vegetation' = TRUE}}{\text{ground plot count}} \times 100\right) < 50$$

$$AND\ \left(\text{count of ground plots where 'Wetland vegetation' = TRUE}\right) \geq 2$$

OR

$$\left(\frac{\text{count of understory plots where 'Wetland vegetation' = TRUE}}{\text{understory plot count}} \times 100\right) < 50$$

$$AND\ \left(\text{count of understory plots where 'Wetland vegetation' = TRUE}\right) \geq 2$$

Variables used in calculation: Understory Plot Wetland Vegetation, Ground Plot Wetland Vegetation, Percent Area Wetland, Contains a Riparian

Other variables using stand - contains a wetland: Water

Stocking Variables

Stand Variable - Basal Area

Description: Total basal area of stand.

Valid values: Basal area must be greater than or equal to zero.
Units: Square feet per acre or square meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\ \sum_{\text{tree observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\ \sum_{\text{understory observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE

Variables used in calculation: Understory Observation Living, Understory Observation DBH, Understory Observation Stems Per Unit Area, Understory Observation Basal Area, Include Dead

Trees in Timber Values, Tree Observation Stems Per Unit Area, Tree Observation Living, Tree Observation Basal Area, Tree Observation DBH

Other variables using stand - basal area: Percent Basal Area Hardwoods, Percent Basal Area Conifer, Percent Basal Area High Value, Percent Basal Area Evergreen, Percent Basal Area Commercial

Stand Variable - Basal Area of AGS

Description: Average total basal area of acceptable growing stock for timber (AGS) in stand.

Valid values: Basal area of AGS must be greater than or equal to zero.
Units: Square feet per acre or square meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\frac{\sum_{\substack{\text{overstory}\\ \text{plots}}} \sum_{\substack{\text{tree}\\ \text{observations}}} \text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Only use observations where 'Timber quality' = "AGS" or "Crop"
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE
    do not include observations where 'Living' is FALSE

Variables used in calculation: Timber Quality, Basal Area, Include Dead Trees in Timber Values, Living, Stems Per Unit Area

Stand Variable - Basal Area of UGS

Description: Average total basal area of unacceptable growing stock for timber (UGS) in stand.

Valid values: Basal area of UGS must be greater than or equal to zero.
Units: Square feet per acre or square meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\ \sum_{\text{tree observations}}\text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}$$

Only use observations where 'Timber quality' = 'UGS'
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Timber Quality, Stems Per Unit Area, Basal Area, Include Dead Trees in Timber Values, Living

Stand Variable - Percent Basal Area High Value

Description: Percent of basal area in high value species.

Valid values: Percent basal area high value must be between 0 and 100.
Units: Percent basal area.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Basal area of high value species}}{\text{Total basal area of stand}} \times 100.0$$

where 'Basal area of high value species' is calculated by:

$$\left(\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\ \sum_{\text{tree observations}}\text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\ \sum_{\text{understory observations}}\text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}\right)$$

Only use observations where the species 'Timber value class' = "high value"
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE

Variables used in calculation: Understory Observation Species, Stand Basal Area, Understory Observation Stems Per Unit Area, Understory Observation Basal Area, Tree Observation Stems Per Unit Area, Tree Observation Species, Tree Observation Basal Area, Timber Value Class

Stand Variable - Percent Basal Area Commercial

Description: Percent of basal area in commercial species.

Valid values: Percent basal area commercial must be between 0 and 100.
Units: Percent basal area.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Basal area of commercial species}}{\text{Total basal area of stand}} \times 100.0$$

where 'Basal area of commercial species' is calculated by:

$$\left(\frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{overstory plots}} \sum_{\text{tree observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{understory plots}} \sum_{\text{understory observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}} \right)$$

Only use observations where the species 'Timber value class' = "high value" or "commercial"
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE

Variables used in calculation: Tree Observation Species, Tree Observation Basal Area, Stand Basal Area, Timber Value Class, Understory Observation Stems Per Unit Area, Understory Observation Species, Understory Observation Basal Area, Tree Observation Stems Per Unit Area

Stand Variable - Percent Basal Area Conifer

Description: Percent of basal area in conifers.

Valid values: Percent basal area conifer must be between 0 and 100.
Units: Percent basal area.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Basal area of conifer species}}{\text{Total basal area of stand}} \times 100.0$$

where 'Basal area of conifer species' is calculated by:

$$\left(\frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{overstory plots}} \sum_{\text{tree observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{understory plots}} \sum_{\text{understory observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}} \right)$$

Only use observations where the Species family category = "Gymnosperm"
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE

Variables used in calculation: Understory Observation Species, Understory Observation Stems Per Unit Area, Understory Observation Basal Area, Category, Family Code, Tree Observation Species, Tree Observation Stems Per Unit Area, Tree Observation Basal Area, Stand Basal Area, Growth Form

Stand Variable - Percent Basal Area Evergreen

Description: Percent of basal area in evergreen trees.

Valid values: Percent basal area evergreen must be between 0 and 100.
Units: Percent basal area.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Basal area of evergreen species}}{\text{Total basal area of stand}} \times 100.0$$

where 'Basal area of evergreen species' is calculated by:

$$\left(\frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{overstory plots}} \sum_{\text{tree observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{understory plots}} \sum_{\text{understory observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}} \right)$$

Only use observations where the Species 'Evergreen' is TRUE
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE

Variables used in calculation: Evergreen, Understory Observation Stems Per Unit Area, Understory Observation Species, Understory Observation Basal Area, Tree Observation Stems Per Unit Area, Tree Observation Species, Tree Observation Basal Area, Stand Basal Area

Stand Variable - Percent Basal Area Hardwoods

Description: Percent of basal area in hardwoods.

Valid values: Percent basal area hardwoods must be between 0 and 100.
Units: Percent basal area.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Basal area of hardwood species}}{\text{Total basal area of stand}} \times 100.0$$

where 'Basal area of hardwood species' is calculated by:

$$\left(\frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{overstory plots}} \sum_{\text{tree observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}} \left(\frac{\sum_{\text{understory plots}} \sum_{\text{understory observations}} \text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}} \right)$$

Only use observations where the Species family category ≠ "Gymnosperm"
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE

Variables used in calculation: Understory Observation Basal Area, Understory Observation Stems Per Unit Area, Category, Family Code, Tree Observation Species, Tree Observation Stems Per Unit Area, Tree Observation Basal Area, Understory Observation Species, Stand Basal Area, Growth Form

Stand Variable - Basal Area in Saplings

Description: Basal area of sapling size trees in stand.

Valid values: Basal area in saplings must be greater than or equal to zero.
Units: Square feet per acre or square meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Only use observations where $1.0 < \text{dbh} \leq 5.0$
IF 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE

Variables used in calculation: Tree Observation Stems Per Unit Area, Tree Observation Basal Area, Understory Observation Living, Understory Observation DBH, Understory Observation Stems Per Unit Area, Understory Observation Basal Area, Include Dead Trees in Timber Values, Tree Observation Living, Tree Observation DBH

Stand Variable - Trees with Fruits and Nuts

Description: Percent basal area of trees with fruits and nuts.

Valid values: Trees with fruits and nuts must be between 0 and 100.
Units: Percent basal area.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Basal area of Showy or eatable fruit trees}}{\text{Total basal area of stand}} \times 100.0$$

where 'Basal area of Showy or eatable fruit trees' is calculated by:

$$\left(\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}\right)$$

Only use observations where the species 'Showy or eatable fruit' is TRUE
Only use observations where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where 'Living' is TRUE
Only use observations where dbh > 1.0

Variables used in calculation: Showy or Edible Fruit, Species, Basal Area, Stems Per Unit Area, Growth Form

Stand Variable - Fall Color Trees

Description: Percent basal area of trees with good fall color.

Valid values: Fall color trees must be between 0 and 100.
Units: Percent basal area.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Basal area of Fall color trees}}{\text{Total basal area of stand}} \times 100.0$$

where 'Basal area of Fall color trees' is calculated by:

$$\left(\frac{\sum_{\substack{\text{plot} \\ \text{clusters}}} \left(\frac{\sum_{\substack{\text{overstory} \\ \text{plots}}} \sum_{\substack{\text{tree} \\ \text{observations}}} \text{Basal area} \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\substack{\text{plot} \\ \text{clusters}}} \left(\frac{\sum_{\substack{\text{understory} \\ \text{plots}}} \sum_{\substack{\text{understory} \\ \text{observations}}} \text{Basal area} \times \text{Stems per unit area}}{\text{understory plot count}} \right)}{\text{count of Plot clusters with understory plots}} \right)$$

Only use observations where the species 'Fall color' is TRUE
Only use observations where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where 'Living' is TRUE
Only use observations where dbh ≥ 1.0

Variables used in calculation: Species, Fall Color, Stems Per Unit Area, Basal Area, Growth Form

Stand Variable - Relative Density of AGS

Description: Average relative density of acceptable growing stock for timber (AGS) in stand.

Valid values: Relative density of AGS must be greater than or equal to zero.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot} \\ \text{clusters}}} \left(\frac{\sum_{\substack{\text{overstory} \\ \text{plots}}} \sum_{\substack{\text{tree} \\ \text{observations}}} \text{Relative density} \times \text{Stems per unit area}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Only use observations where 'Timber quality' = "AGS" or "Crop"
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE
    do not include observations where 'Living' is FALSE

Variables used in calculation: Timber Quality, Stems Per Unit Area, Relative Density, DBH, Living, Include Dead Trees in Timber Values

Stand Variable - Relative Density of UGS

Description: Average relative density of unacceptable growing stock for timber (UGS) in stand.

Valid values: Relative density of UGS must be greater than or equal to zero.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Relative density} \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}$$

Only use observations where 'Timber quality' = "UGS"
Only use observations where dbh ≥ 1.0
IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Relative Density, Stems Per Unit Area, DBH, Include Dead Trees In Timber Values, Living, Timber Quality

Stand Variable - Relative Density

Description: Relative density of stand.

Valid values: Relative density must be greater than or equal to zero.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Relative density} \times \text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Relative density} \times \text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Only use observations where dbh ≥ 1.0
if 'Include dead trees in timber values' = FALSE do not include observations where 'Living' is FALSE

Variables used in calculation: Understory Observation Stems Per Unit Area, Tree Observation Stems Per Unit Area, Understory Observation Relative Density, Understory Observation Living, Tree Observation DBH, Tree Observation Relative Density, Include Dead Trees in Timber Values, Tree Observation Living, Understory Observation DBH

Timber Volume and Value Variables

Stand Variable - Board-foot Value

Description: Dollar value of sawtimber products.

Valid values: Board-foot value must be greater than or equal to zero.
Units: Dollars per acre or dollars per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Board-foot value}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Board-foot Value

Other variables using stand - board-foot value: Timber Value of the Stand

Stand Variable - Pulpwood Value

Description: Dollar value of pulpwood products.

Valid values: Pulpwood value must be greater than or equal to zero.
Units: Dollars per acre or dollars per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Pulpwood value}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Pulpwood Value

Other variables using stand - pulpwood value: Timber Value of the Stand

Stand Variable - Gross Board-foot Volume

Description: Gross board-foot volume per unit area (MBF).

Valid values: Gross board-foot volume must be greater than or equal to zero.
Units: Board feet per acre or board feet per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Gross board-foot volume}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Gross Board-foot Volume

Stand Variable - Gross Cord Volume

Description: Gross whole-tree cords per unit area.

Valid values: Gross cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Gross cord volume}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Gross Cord Volume

Stand Variable - Gross Cubic Volume

Description: Gross whole-tree cubic volume per unit area.

Valid values: Gross cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Gross pulpwood volume + Gross sawlog cubic volume

Variables used in calculation: Gross Pulpwood Volume, Gross Sawtimber Cubic Volume

Stand Variable - Gross Pulpwood Cord Volume

Description: Gross cord volume per unit area excluding volume in sawtimber.

Valid values: Gross pulpwood cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}} \left(\sum_{\text{overstory plots}} \frac{\text{Gross pulpwood cord volume}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Gross Pulpwood Cord Volume

Stand Variable - Gross Pulpwood Volume

Description: Gross cubic volume per unit area excluding volume in sawtimber.

Valid values: Gross pulpwood volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Gross pulpwood volume}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Gross Pulpwood Volume

Other variables using stand - gross pulpwood volume: Gross Cubic Volume, Net Cubic Volume

Stand Variable - Gross Sawtimber Cubic Volume

Description: Gross cubic volume per unit area in sawtimber.

Valid values: Gross sawtimber cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Gross sawlog cubic volume}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Gross Sawtimber Cubic Volume

Other variables using stand - gross sawtimber cubic volume: Net Cubic Volume, Gross Cubic Volume

Stand Variable - Gross Tons Pulpwood

Description: Gross tons per unit area excluding sawtimber.

Valid values: Gross tons pulpwood must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Gross tons pulpwood}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Gross Tons Pulpwood

Stand Variable - Gross Tons

Description: Gross whole-tree tons per unit area.

Valid values: Gross tons must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \left(\sum_{\substack{\text{overstory}\\ \text{plots}}} \frac{\text{Gross tons}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Gross Tons

Stand Variable - Net Board-foot Volume

Description: Net board-foot volume per unit area (MBF).

Valid values: Net board-foot volume must be greater than or equal to zero.
Units: Board feet per acre or board feet per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}} \left(\sum_{\text{overstory plots}} \frac{\text{Net board-foot volume}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Net Board-foot Volume

Stand Variable - Net Cord Volume

Description: Net whole-tree cords per unit area.

Valid values: Net cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}} \left(\sum_{\text{overstory plots}} \frac{\text{Net cord volume}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Net Cord Volume

Stand Variable - Net Cubic Volume

Description: Net whole-tree cubic volume per unit area.

Valid values: Net cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\text{Net pulpwood volume} + \text{Net sawlog cubic volume}$$

Variables used in calculation: Gross Sawtimber Cubic Volume, Gross Pulpwood Volume

Stand Variable - Net Pulpwood Cord Volume

Description: Net cord volume per unit area excluding volume in sawtimber.

Valid values: Net pulpwood cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Net pulpwood cord volume}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Net Pulpwood Cord Volume

Stand Variable - Net Pulpwood Volume

Description: Net cubic volume per unit area excluding volume in sawtimber.

Valid values: Net pulpwood volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Net pulpwood volume}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Net Pulpwood Cubic Volume

Stand Variable - Net Sawtimber Cubic Volume

Description: Net cubic volume per unit area in sawtimber.

Valid values: Net sawtimber cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}} \left(\sum_{\text{overstory plots}} \frac{\text{Net sawlog cubic volume}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Net Sawtimber Cubic Volume

Stand Variable - Net Tons Pulpwood

Description: Net tons per unit area excluding sawtimber.

Valid values: Net tons pulpwood must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}} \left(\sum_{\text{overstory plots}} \frac{\text{Net tons pulpwood}}{\text{overstory plot count}} \right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Net Tons Pulpwood

Stand Variable - Net Tons

Description: Net whole-tree tons per unit area.

Valid values: Net tons must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Net tons}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Net Tons

Stand Variable - Pulpwood Value

Description: Dollar value of pulpwood products.

Valid values: Pulpwood value must be greater than or equal to zero.
Units: Dollars per acre or dollars per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\\text{clusters}}}\left(\sum_{\substack{\text{overstory}\\\text{plots}}}\frac{\text{Pulpwood value}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}}$$

Variables used in calculation: Pulpwood Value

Other variables using stand - pulpwood value: Timber Value of the Stand

Timber Value of the Stand Variable

Description: Value of the stand's timber products per unit area.

Valid values: Timber value of the stand must be greater than or equal to zero.
Units: Dollars per acre or dollars per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\text{Pulpwood value} + \text{Board-foot value}$$

Variables used in calculation: Pulpwood Value, Board-foot Value

Visual Quality Variables

Stand Variable - Trees with Showy Flowers

Description: Number of trees with showy flowers per unit area in stand.

Valid values: Trees with showy flowers must be greater than or equal to zero.
Units: Stems per acre or stems per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\text{Stems per unit area}}{\text{overstory plot count}}\right)}{\text{count of Plot clusters with overstory plots}} + \frac{\sum_{\text{plot clusters}}\left(\frac{\sum_{\text{understory plots}}\sum_{\text{understory observations}}\text{Stems per unit area}}{\text{understory plot count}}\right)}{\text{count of Plot clusters with understory plots}}$$

Only use observations where the species 'Showy flowers' is TRUE
Only use observations where the species 'Growth form' is "Tree" or "Shrub"
Only use observations where 'Living' is TRUE
Only use observations where dbh ≥ 1.0

Variables used in calculation: Showy Flowers, Species, Stems Per Unit Area, Basal Area, Growth Form

Stand Variable - Fall Color Ground Layer

Description: Percent cover of species in the ground layer < 3 feet in height with good fall color.

Valid values: Fall Color Ground Layer must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{plot clusters}}\text{Ground layer with fall color}}{\text{count of Plot clusters with ground plots}}$$

Variables used in calculation: Ground Layer with Fall Color

Stand Variable - Shrub Layer with Fall Color

Description: Percent cover of species in the shrub layer between 3-10 feet in height with good fall color.

Valid values: Shrub layer with fall color must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{plot}\\ \text{clusters}}} \text{Shrub layer with fall color}}{\text{count of Plot clusters with understory or ground plots}}$$

Variables used in calculation: Shrub Layer with Fall Color

Stand Variable - Percent Plots with Interesting Trees

Description: Percent of plots with interesting trees.

Valid values: Percent plots with interesting trees must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count of plot clusters where 'Interesting tree' = TRUE}}{\text{count of Plot clusters with overstory plots or transects}} \right) \times 100$$

Variables used in calculation: Interesting Tree Present

Stand Variable - Ground Layer with Showy Flowers

Description: Percent cover of species in the ground layer < 3 feet in height with showy flowers.

Valid values: Ground Layer with Showy Flowers must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count plot clusters where 'Flowering ground'} = \text{TRUE}}{\text{count of Plot clusters with ground plots}}\right) \times 100$$

Variables used in calculation: Ground Layer with Showy Flowers

Stand Variable - Shrubs with Showy Flowers

Description: Percent cover of species in the shrub layer between 3−10 feet in height with showy flowers.

Valid values: Shrubs with showy flowers must be between 0 and 100.
Units: Percent plots.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\left(\frac{\text{count plot clusters where 'Flowering shrub'} = \text{TRUE}}{\text{count of Plot clusters with understory or ground plots}}\right) \times 100$$

Variables used in calculation: Shrub Layer with Showy Flowers

Cluster Variables

Tallied Cluster Variables

Plot Cluster Variable - Cluster ID

Description: Plot cluster identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the cluster identification name or number.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

value of CLUSTER + 1

Other variables using plot cluster - cluster id: Understory Plot Plot ID, Overstory Plot Plot ID, Ground Plot Plot ID, Transect ID

Plot Cluster Variable - Map X-coordinate

Description: Map x coordinate.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record Global positioning system coordinates of the cluster center point.
NED default value: None.
User-set default: Yes.
Calculated: No.

Plot Cluster Variable - Map Y-coordinate

Description: Map y coordinate.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the cluster center point.
NED default value: None.
User-set default: Yes.
Calculated: No.

Plot Cluster Variable - Average Dbh

Description: Average (arithmetic mean) dbh of trees in plot cluster.

Valid values: Average dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{overstory}\\\text{plots}}}\sum_{\substack{\text{tree}\\\text{observations}}}\left(\text{dbh}\times\frac{\text{Stems per unit area}}{\text{overstory plot count}}\right)+\sum_{\substack{\text{understory}\\\text{plots}}}\sum_{\substack{\text{understory}\\\text{observations}}}\left(\text{dbh}\times\frac{\text{Stems per unit area}}{\text{understory plot count}}\right)}{\sum_{\substack{\text{overstory}\\\text{plots}}}\sum_{\substack{\text{tree}\\\text{observations}}}\left(\frac{\text{Stems per unit area}}{\text{overstory plot count}}\right)+\sum_{\substack{\text{understory}\\\text{plots}}}\sum_{\substack{\text{understory}\\\text{observations}}}\left(\frac{\text{Stems per unit area}}{\text{understory plot count}}\right)}$$

only use observations where dbh ≥ 1.0

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH

Calculated Cluster Variables

Plot Cluster Variable - Average Shrub Layer Height

Description: Average height of plants between 3 and 10 feet.

Valid values: Average shrub layer height must be between 3 and 10 feet.
Units: Feet or meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\left(\sum_{\substack{\text{ground}\\\text{plots}}}\text{Average shrub layer height}\right)+\left(\sum_{\substack{\text{understory}\\\text{plots}}}\text{Average shrub layer height}\right)}{\text{ground plot count + understory plot count}}$$

Only use plots where the shrub layer height is ≥ 3.0

Variables used in calculation: Ground Plot Average Shrub Layer Height, Understory Plot Average Shrub Layer Height

Other variables using plot cluster - average shrub layer height: Average Shrub Layer Height

Plot Cluster Variable - Coniferous Shrub Layer

Description: Plot cluster contains coniferous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.

Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

```
TRUE if any Ground plot or any Understory plot is found where
    'Coniferous shrub' = TRUE
```

Variables used in calculation: Understory Plot Coniferous Shrub Layer, Ground Plot Coniferous Shrub Layer

Other variables using plot cluster - coniferous shrub layer: Coniferous Shrub Layer

Plot Cluster Variable - Deciduous Shrub Layer

Description: Plot cluster contains deciduous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

```
TRUE if any Ground plot or any Understory plot is found where
    'Deciduous shrub' = TRUE
```

Variables used in calculation: Ground Plot Deciduous Shrub Layer, Understory Plot Deciduous Shrub Layer

Other variables using plot cluster - deciduous shrub layer: Deciduous Shrub Layer

Plot Cluster Variable - Ericaceous Shrub Layer

Description: Plot cluster contains ericaceous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

```
TRUE if any Ground plot or any Understory plot is found where
    'Ericaceous shrub' = TRUE
```

Variables used in calculation: Ground Plot Ericaceous Shrub Layer, Understory Plot Ericaceous Shrub Layer

Other variables using plot cluster - ericaceous shrub layer: Ericaceous Shrub Layer

Plot Cluster Variable - Exotic Plants Present

Description: Exotic plant species present in plot cluster.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

```
TRUE if
        any Overstory observation has a species where 'Exotic' = TRUE
    OR
        any Understory observation has a species where 'Exotic' = TRUE
    OR
        any Ground observation has a species where 'Exotic' = TRUE
```

Variables used in calculation: Exotic, Tree Observation Species, Ground Observation Species, Understory Observation Species

Other variables using plot cluster - exotic plants present: Exotics

Plot Cluster Variable - Ground Layer with Fall Color

Description: Percent cover of species with good fall color less than 3 feet in height.

Valid values: Ground layer with fall color must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{ground plots}} \text{Percent ground fall color}}{\text{ground plot count}}$$

Variables used in calculation: Cover of Fall Color in Ground Layer

Other variables using plot cluster - ground layer with fall color: Fall Color Ground Layer

Plot Cluster Variable - Ground Layer with Fruits and Nuts

Description: Percent cover of species less than 3 feet in height that bear fruits and nuts.

Valid values: Ground layer with fruits and nuts must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{ground plots}} \text{Percent ground fruiting}}{\text{ground plot count}}$$

Variables used in calculation: Cover of Fruiting Plants in Ground Layer

Other variables using plot cluster - ground layer with fruits and nuts: Ground Layer with Fruits and Nuts

Plot Cluster Variable - Ground Layer with Showy Flowers

Description: Plot cluster contains ground plants that produce showy flowers.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

```
TRUE if any Ground plot is found where
    'Flowering ground' = TRUE
```

Variables used in calculation: Flowery Ground Layer

Other variables using plot cluster - ground layer with showy flowers: Ground Layer with Showy Flowers

Plot Cluster Variable - Hard Mast Present

Description: Plot cluster contains species that produce hard mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

```
TRUE if
        any Overstory plot has 'Hard mast' = TRUE
    OR
        any Understory plot has 'Hard mast' = TRUE
    OR
        any Ground plot has 'Hard mast' = TRUE
```

Variables used in calculation: Ground Plot Hard Mast, Understory Plot Hard Mast, Hard Mast Present

Other variables using plot cluster - hard mast present: Hard Mast

Plot Cluster Variable - Interesting Tree Present

Description: Presence of visually interesting tree.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

TRUE if
any Overstory observation has 'Visually interesting' = TRUE
OR
any Transect has 'Interesting tree' = TRUE

Variables used in calculation: Interesting Tree, Visually Interesting

Other variables using plot cluster - interesting tree present: Percent Plots with Interesting Trees

Plot Cluster Variable - Litter Depth

Description: Depth of litter.

Valid values: Litter depth must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{ground plots}} \text{Litter depth}}{\text{ground plot count}}$$

Variables used in calculation: Litter Depth

Other variables using plot cluster - litter depth: Litter Depth

Plot Cluster Variable - Medial DBH

Description: Medial dbh of trees in plot cluster.

Valid values: Medial dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{overstory}\\\text{plots}}}\sum_{\substack{\text{tree}\\\text{observations}}}\left(\text{dbh}^3\times\frac{\text{Stems per unit area}}{\text{overstory plot count}}\right)+\sum_{\substack{\text{understory}\\\text{plots}}}\sum_{\substack{\text{understory}\\\text{observations}}}\left(\text{dbh}^3\times\frac{\text{Stems per unit area}}{\text{understory plot count}}\right)}{\sum_{\substack{\text{overstory}\\\text{plots}}}\sum_{\substack{\text{tree}\\\text{observations}}}\left(\text{dbh}^2\times\frac{\text{Stems per unit area}}{\text{overstory plot count}}\right)+\sum_{\substack{\text{understory}\\\text{plots}}}\sum_{\substack{\text{understory}\\\text{observations}}}\left(\text{dbh}^2\times\frac{\text{Stems per unit area}}{\text{understory plot count}}\right)}$$

only use observations where dbh ≥ 1.0

Variables used in calculation: Tree Observation DBH, Understory Observation Stems Per Unit Area, Tree Observation Stems Per Unit Area, Understory Observation DBH

Plot Cluster Variable - Merchantable Medial DBH

Description: Medial dbh of merchantable trees in plot cluster.

Valid values: Merchantable medial dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{overstory}\\\text{plots}}}\sum_{\substack{\text{tree}\\\text{observations}}}\left(\text{dbh}^3\times\frac{\text{Stems per unit area}}{\text{overstory plot count}}\right)+\sum_{\substack{\text{understory}\\\text{plots}}}\sum_{\substack{\text{understory}\\\text{observations}}}\left(\text{dbh}^3\times\frac{\text{Stems per unit area}}{\text{understory plot count}}\right)}{\sum_{\substack{\text{overstory}\\\text{plots}}}\sum_{\substack{\text{tree}\\\text{observations}}}\left(\text{dbh}^2\times\frac{\text{Stems per unit area}}{\text{overstory plot count}}\right)+\sum_{\substack{\text{understory}\\\text{plots}}}\sum_{\substack{\text{understory}\\\text{observations}}}\left(\text{dbh}^2\times\frac{\text{Stems per unit area}}{\text{understory plot count}}\right)}$$

only use observations where dbh > 5.5

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH

Plot Cluster Variable - Merchantable Quadratic Mean DBH

Description: Quadratic mean dbh of merchantable trees in plot cluster.

Valid values: Merchantable quadratic mean dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sqrt{\frac{\sum_{\text{overstory plots}} \sum_{\text{tree observations}} \left(\text{dbh}^2 \times \frac{\text{Stems per unit area}}{\text{overstory plot count}} \right) + \sum_{\text{understory plots}} \sum_{\text{understory observations}} \left(\text{dbh}^2 \times \frac{\text{Stems per unit area}}{\text{understory plot count}} \right)}{\sum_{\text{overstory plots}} \sum_{\text{tree observations}} \left(\frac{\text{Stems per unit area}}{\text{overstory plot count}} \right) + \sum_{\text{understory plots}} \sum_{\text{understory observations}} \left(\frac{\text{Stems per unit area}}{\text{understory plot count}} \right)}}$$

only use observations where dbh > 5.5

Variables used in calculation: Understory Observation DBH, Understory Observation Stems Per Unit Area, Tree Observation Stems Per Unit Area, Tree Observation DBH

Plot Cluster Variable - Percent Ground Cover

Description: Percent cover of foliage between 0 and 3 feet in height.

Valid values: Percent ground cover must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\text{ground plots}} \text{Percent ground cover}}{\text{ground plot count}}$$

Variables used in calculation: Cover of Foliage in Ground Layer

Other variables using plot cluster - percent ground cover: Ground Layer Percent Cover

Plot Cluster Variable - Quadratic Mean DBH

Description: Quadratic mean dbh of trees in plot cluster.

Valid values: Quadratic mean dbh must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sqrt{\frac{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\left(\text{dbh}^2\times\frac{\text{Stems per unit area}}{\text{overstory plot count}}\right)+\sum_{\text{understory plots}}\sum_{\text{understory observations}}\left(\text{dbh}^2\times\frac{\text{Stems per unit area}}{\text{understory plot count}}\right)}{\sum_{\text{overstory plots}}\sum_{\text{tree observations}}\left(\frac{\text{Stems per unit area}}{\text{overstory plot count}}\right)+\sum_{\text{understory plots}}\sum_{\text{understory observations}}\left(\frac{\text{Stems per unit area}}{\text{understory plot count}}\right)}}$$

only use observations where dbh ≥ 1.0

Variables used in calculation: Understory Observation Stems Per Unit Area, Understory Observation DBH, Tree Observation Stems Per Unit Area, Tree Observation DBH

Plot Cluster Variable - Rare Plants Present

Description: Rare plant species present in plot cluster.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

TRUE if
    any Overstory observation has a species where 'Rare' = TRUE
  OR
    any Understory observation has a species where 'Rare' = TRUE
  OR
    any Ground observation has a species where 'Rare' = TRUE

Variables used in calculation: Rare, Ground Observation Species, Understory Observation Species, Tree Observation Species

Other variables using plot cluster - rare plants present: Rare

Plot Cluster Variable - Soft Mast

Description: Plot cluster contains species that produce soft mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

TRUE if
any Overstory plot has 'Soft mast' = TRUE
OR
any Understory plot has 'Soft mast' = TRUE
OR
any Ground plot has 'Soft mast' = TRUE

Variables used in calculation: Overstory Plot Soft Mast, Understory Plot Soft Mast, Ground Plot Soft Mast

Other variables using plot cluster - soft mast: Soft Mast

Plot Cluster Variable - Shrub Layer Percent Cover

Description: Percent cover of foliage between 3 and 10 feet in height.

Valid values: Shrub layer percent cover must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\left(\sum_{\substack{\text{ground}\\ \text{plots}}} \frac{\text{Percent shrub cover}}{\text{ground plot count}} \right) + \left(\sum_{\substack{\text{understory}\\ \text{plots}}} \frac{\text{Percent shrub cover}}{\text{understory plot count}} \right)$$

if the calculation > 100.0, the value is set to 100.0

Variables used in calculation: Ground Plot Cover of Foliage in Shrub Layer, Understory Plot Cover of Foliage in Shrub Layer

Other variables using plot cluster - shrub layer percent cover: Shrub Layer Percent Cover

Plot Cluster Variable - Shrub Layer with Fall Color

Description: Percent cover with good fall color between 3 and 10 feet in height.

Valid values: Shrub layer with fall color must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.

User-set default: No.
Calculated: Yes.

$$\left(\sum_{\substack{\text{ground} \\ \text{plots}}} \frac{\text{Percent shrub fall color}}{\text{ground plot count}} \right) + \left(\sum_{\substack{\text{understory} \\ \text{plots}}} \frac{\text{Percent shrub fall color}}{\text{understory plot count}} \right)$$

if the calculation > 100.0, the value is set to 100.0

Variables used in calculation: Ground Plot Cover of Fall Color in Shrub Layer, Understory Plot Cover of Fall Color in Shrub Layer

Other variables using plot cluster - shrub layer with fall color: Shrub Layer with Fall Color

Plot Cluster Variable - Shrub Layer with Fruits and Nuts

Description: Percent cover of species between 3 and 10 feet in height that bear fruits and nuts.

Valid values: Shrub layer with fruits and nuts must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\left(\sum_{\substack{\text{ground} \\ \text{plots}}} \frac{\text{Percent shrub fruiting}}{\text{ground plot count}} \right) + \left(\sum_{\substack{\text{understory} \\ \text{plots}}} \frac{\text{Percent shrub fruiting}}{\text{understory plot count}} \right)$$

if the calculation > 100.0, the value is set to 100.0

Variables used in calculation: Ground Plot Cover of Fruiting Plants in Shrub Layer, Understory Plot Cover of Fruiting Plants in Shrub Layer

Other variables using plot cluster - shrub layer with fruits and nuts: Shrub Layer with Fruits and Nuts

Plot Cluster Variable - Shrub Layer with Showy Flowers

Description: Plot cluster contains shrub plants that produce showy flowers.

Units: Present/absent.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: FALSE.

User-set default: No.
Calculated: Yes.

```
TRUE if any Ground plot or any Understory plot is found where
    'Flowering shrub' = TRUE
```

Variables used in calculation: Ground Plot Flowery Shrub Layer, Understory Plot Flowery Shrub Layer

Other variables using plot cluster - shrub layer with showy flowers: Shrubs with Showy Flowers

Plot Cluster Variable - Stocked with Commercial Regeneration

Description: Stocked with commercial regeneration.

Units: Yes/no.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

```
TRUE if
        and Understory plot has 'Stocked with commercial regen' = TRUE
    OR
        and Ground plot has 'Stocked with commercial regen' = TRUE
```

Variables used in calculation: Ground plot stocked with Commercial Regen., Understory Plot Stocked with Commercial Regen.

Other variables using plot cluster - stocked with commercial regen.: Percent Plots Stocked with Commercial Regen.

Plot Cluster Variable - Stocked with High Value Regeneration

Description: Stocked with high value regeneration.

Units: Yes/no.
Variable type: Boolean.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

TRUE if
any Understory plot has 'Stocked with high value regen' = TRUE
OR
any Ground plot has 'Stocked with high value regen' = TRUE

Variables used in calculation: Ground Plot Stocked with High Value Regen., Understory Plot Stocked with High Value Regen.

Other variables using plot cluster - stocked with high value regen.: Percent Plots Stocked with High Value Regen.

Overstory Variables

Tallied Overstory Plot Variables

Overstory Plot Variable - Canopy Closure

Description: Percent canopy closure.

Valid values: Canopy closure must be between 0 and 100.
Units: Percent closure.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent cover of the overstory trees (trees greater than 30 feet in height).
NED default value: None.
User-set default: Yes.
Calculated: Yes.

if (Relative density < 100)
Canopy closure = Relative density
else if (Relative density >= 100)
Canopy closure = 100

where:
$$\text{Relative density} = \sum_{\substack{\text{tree} \\ \text{observations}}} \text{Relative density} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Relative Density, Stems Per Unit Area, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - canopy closure: Percent Open Plots, Canopy Closure

Overstory Plot Variable - User Comments

Description: User comments/notes.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter any additional comments about the overstory plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Overstory Plot Variable - Hard Mast Present

Description: Plot contains species that produce hard mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if any tree present in the plot produces hard mast. The variable will default to absent but will be calculated by NED-2 if species known to produce hard mast are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Mast type' is "hard" or "hard and soft" for the observation species
AND 'Living' = TRUE

Variables used in calculation: Mast Type, Living, Species

Other variables using overstory plot - hard mast present: Hard Mast Present

Overstory Plot Variable - Map X-coordinate

Description: Map x coordinate units depend on map type.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the overstory plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Overstory Plot Variable - Map Y-coordinate

Description: Map y coordinate units depend on map type.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the overstory plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Overstory Plot Variable - Midstory Closure

Description: Percent midstory closure.

Valid values: Midstory Closure must be between 0 and 100.
Units: Percent closure.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent cover of the midstory trees (trees between 10 and 30 feet high).
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using overstory plot - midstory closure: Mixed Midstory, Coniferous Midstory, Deciduous Midstory

Overstory Plot Variable - Midstory Type

Description: Midstory type.

Valid values: Midstory type must be 1=“deciduous”, 2=“coniferous”, or 3=“mixed”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. If there is at least 25% midstory cover, enter whether it is 1 = D = deciduous; 2 = C = coniferous; or 3 = M = mix of coniferous and deciduous species (mixed = at least 1 coniferous and at least 1 deciduous).
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using overstory plot - midstory type: Mixed Midstory, Deciduous Midstory, Coniferous Midstory

Overstory Plot Variable - Plot ID

Description: Overstory plot identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the overstory plot name or number.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

```
IF there is only one plot in the cluster
      ID = the ID of the cluster
ELSE
      ID = the concatenation of the Cluster ID with a
      colon with the value of OVER_PLOT + 1     .
```

Variables used in calculation: Cluster ID

Other variables using overstory plot - plot id: Tree ID

Overstory Plot Variable - Riparian Plot

Description: Any portion of plot is in riparian zone.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if any portion of the plot is in a riparian zone.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using overstory plot - riparian plot: Contains a Riparian, Riparian

Overstory Plot Variable - Soft Mast

Description: Plot contains species that produce soft mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if any tree produces soft mast. The variable will default to absent but will be calculated by NED-2 if species known to produce soft mast are present in the inventory.

NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Mast type' is "soft" or "hard and soft" for the observation species
AND 'Living' = TRUE

Variables used in calculation: Mast Type, Living, Species

Other variables using overstory plot - soft mast: Soft Mast

Overstory Plot Variables

Overstory Plot Variable - Aboveground Biomass

Description: Aboveground dry-weight biomass.

Valid values: Aboveground biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Aboveground biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Aboveground Biomass, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - aboveground biomass: Aboveground Biomass

Overstory Plot Variable - Board-foot Value

Description: Dollar value of sawtimber products.

Valid values: Board-foot Value must be greater than or equal to zero.
Units: Dollars per acre or dollars per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Board-foot value} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Board-foot Value, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - board-foot value: Board-foot Value, Dollar Value

Overstory Plot Variable - Branch Biomass

Description: Branch dry-weight biomass.

Valid values: Branch biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Branch biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Branch Biomass

Other variables using overstory plot - branch biomass: Branch Biomass

Overstory Plot Variable - Coarse Root Biomass

Description: Coarse root dry-weight biomass.

Valid values: Coarse root biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Coarse root biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Coarse Root Biomass, Stems Per Unit Area, Living, Include Dead Trees in Timber Values

Other variables using overstory plot - coarse root biomass: Coarse Root Biomass

Overstory Plot Variable - Dead Cavity Tree Present

Description: Dead tree with cavity found in plot.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

TRUE if any tree observation has
'Cavity' = TRUE AND 'Living' = FALSE

Variables used in calculation: Living, Cavity

Other variables using overstory plot - dead cavity tree present: Dead Cavity Tree

Overstory Plot Variable - Dollar Value

Description: Dollar value of timber products.

Valid values: Dollar value must be greater than or equal to zero.
Units: Dollars per acre or dollars per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Pulpwood value + Board-foot value

Variables used in calculation: Board-foot Value, Pulpwood Value

Overstory Plot Variable - Foliage Biomass

Description: Foliage dry-weight biomass.

Valid values: Foliage biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Foliage biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Foliage Biomass, Stems Per Unit Area, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - foliage biomass: Foliage Biomass

Overstory Plot Variable - Hard Mast Present

Description: Plot contains species that produce hard mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if any tree present in the plot produces hard mast. The variable will default to absent but will be calculated by NED-2 if species known to produce hard mast are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Mast type' is "hard" or "hard and soft" for the observation species
AND 'Living' = TRUE

Variables used in calculation: Mast Type, Living, Species

Other variables using overstory plot - hard mast present: Hard Mast Present

Overstory Plot Variable - Inventory Plot Count

Description: Number of plots in original inventory.

Valid values: Inventory plot count must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF this is the inventory snapshot
Original inventory plot count = 1
ELSE
Plot clusters containing simulated data always have one overstory plot,
one understory plot, one ground plot and one transect.

Overstory Plot Variable - Live Cavity Tree Present

Description: Live tree with cavity found in plot.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: No.
NED default value: FALSE.
User-set default: No.
Calculated: Yes.

TRUE if any tree observation has
'Cavity' = TRUE AND 'Living' = TRUE

Variables used in calculation: Living, Cavity

Other variables using overstory plot - live cavity tree present: Live Cavity Tree

Overstory Plot Variable - Gross Board-foot Volume

Description: Gross board-foot volume per unit area (MBF).

Valid values: Gross Board-foot Volume must be greater than or equal to zero.
Units: Board feet per acre or board feet per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Gross board-foot volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Gross Board-foot Volume, Living, Include Dead Trees in Timber Values

Other variables using overstory plot - gross board-foot volume: Gross Board-foot Volume

Overstory Plot Variable - Gross Cord Volume

Description: Gross whole-tree cords per unit area.

Valid values: Gross cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Gross cord volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Living, Include Dead Trees in Timber Values, Stems Per Unit Area, Gross Cord Volume

Other variables using overstory plot - gross cord volume: Gross Cord Volume

Overstory Plot Variable - Gross Cubic Volume

Description: Gross whole-tree cubic volume per unit area.

Valid values: Gross cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\text{Gross pulpwood volume} + \text{Gross sawlog cubic volume}$$

Variables used in calculation: Gross Sawtimber Cubic Volume, Gross Pulpwood Volume

Overstory Plot Variable - Gross Pulpwood Cord Volume

Description: Gross cord volume per unit area excluding volume in sawtimber.

Valid values: Gross pulpwood cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Gross pulpwood cord volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Gross Pulpwood Cord Volume, Include Dead Trees in Timber Values, Living, Stems Per Unit Area

Other variables using overstory plot - gross pulpwood cord volume: Gross Pulpwood Cord Volume

Overstory Plot Variable - Gross Pulpwood Volume

Description: Gross cubic volume per unit area excluding volume in sawtimber.

Valid values: Gross pulpwood volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Gross pulpwood cubic volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Gross Pulpwood Cubic Volume, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - gross pulpwood volume: Gross Cubic Volume, Gross Pulpwood Volume

Overstory Plot Variable - Gross Sawtimber Cord Volume

Description: Gross cord volume per unit area in sawtimber portion of tree.

Valid values: Gross sawtimber cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Gross sawlog cord volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Gross Sawtimber Cord Volume

Other variables using overstory plot - gross sawtimber cord volume: Gross Sawtimber Cord Volume

Overstory Plot Variable - Gross Sawtimber Cubic Volume

Description: Gross cubic volume per unit area in sawtimber.

Valid values: Gross sawtimber cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Gross sawlog cubic volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Gross Sawtimber Cubic Volume

Other variables using overstory plot - gross sawtimber cubic volume: Gross Cubic Volume, Gross Sawtimber Cubic Volume

Overstory Plot Variable - Gross Tons Pulpwood

Description: Gross tons per unit area excluding sawtimber.

Valid values: Gross Tons Pulpwood must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Gross tons pulpwood} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Gross Tons Pulpwood

Other variables using overstory plot - gross tons pulpwood: Gross Tons Pulpwood

Overstory Plot Variable - Gross Tons Sawtimber

Description: Gross tons per unit area in sawtimber portion of tree.

Valid values: Gross tons sawtimber must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Gross tons sawlogs} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Living, Gross Tons Sawtimber, Include Dead Trees in Timber Values, Stems Per Unit Area

Other variables using overstory plot - gross tons sawtimber: Gross Tons Sawtimber

Overstory Plot Variable - Gross Tons

Description: Gross whole-tree tons per unit area.

Valid values: Gross tons must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Gross tons} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Gross Tons

Other variables using overstory plot - gross tons: Gross Tons

Overstory Plot Variable - Net Board-foot Volume

Description: Net board-foot volume per unit area (MBF).

Valid values: Net board-foot volume must be greater than or equal to zero.
Units: Board feet per acre or board feet per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Net board-foot volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Net Board-foot Volume, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - net board-foot volume: Net Board-foot Volume

Overstory Plot Variable - Net Cord Volume

Description: Net whole-tree cords per unit area.

Valid values: Net cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Net cord volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Net Cord Volume

Other variables using overstory plot - net cord volume: Net Cord Volume

Overstory Plot Variable - Net Cubic Volume

Description: Net whole-tree cubic volume per unit area.

Valid values: Net cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Net pulpwood volume + Net sawlog cubic volume

Variables used in calculation: Net Pulpwood Cubic Volume, Net Sawtimber Cubic Volume

Overstory Plot Variable - Net Pulpwood Cord Volume

Description: Net cord volume per unit area excluding volume in sawtimber.

Valid values: Net Pulpwood Cord Volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Net pulpwood cord volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Net Pulpwood Cord Volume, Include Dead Trees in Timber Values, Stems Per Unit Area, Living

Other variables using overstory plot - net pulpwood cord volume: Net Pulpwood Cord Volume

Overstory Plot Variable - Net Pulpwood Cubic Volume

Description: Net cubic volume per unit area excluding volume in sawtimber.

Valid values: Net pulpwood cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Net pulpwood volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Net Pulpwood Volume, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - net pulpwood cubic volume: Net Cubic Volume, Net Pulpwood Volume

Overstory Plot Variable - Net Sawtimber Cord Volume

Description: Net cord volume per unit area in sawtimber portion of tree.

Valid values: Net sawtimber cord volume must be greater than or equal to zero.
Units: Cords per acre or cords per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Net sawlog cord volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Net Sawtimber Cord Volume

Other variables using overstory plot - net sawtimber cord volume: Net Sawtimber Cord Volume

Overstory Plot Variable - Net Sawtimber Cubic Volume

Description: Net cubic volume per unit area in sawtimber.

Valid values: Net sawtimber cubic volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Net sawlog cubic volume} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Net Sawtimber cubic volume

Other variables using overstory plot - net sawtimber cubic volume: Net Cubic Volume, Net Sawtimber Cubic Volume

Overstory Plot Variable - Net Tons

Description: Net whole-tree tons per unit area.

Valid values: Net tons must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree} \\ \text{observations}}} \text{Net tons} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Net Tons

Other variables using overstory plot - net tons: Net Tons

Overstory Plot Variable - Net Tons Pulpwood

Description: Net tons per unit area excluding sawtimber.

Valid values: Net tons pulpwood must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Net tons pulpwood} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Net Tons Pulpwood

Other variables using overstory plot - net tons pulpwood: Net Tons Pulpwood

Overstory Plot Variable - Net Tons Sawtimber

Description: Net tons per unit area in sawtimber portion of tree.

Valid values: Net tons sawtimber must be greater than or equal to zero.
Units: Tons per acre or tonnes per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Net tons sawlogs} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Net Tons Sawtimber

Other variables using overstory plot - net tons sawtimber: Net Tons Sawtimber

Overstory Plot Variable - Plot Size Class

Description: Plot size class.

Valid values: Plot size class must be 1=“regeneration”, 2=“sapling”, 3=“pole”, 4=“small sawtimber”, or 5=“large sawtimber”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: No.

NED default value: None.
User-set default: No.
Calculated: Yes.

IF (medial diameter < 1.0)
Plot size class = "regeneration"
IF (1.0 ≤ medial diameter ≤ 4.5)
Plot size class = "sapling"
IF (4.5 < medial diameter ≤ 10.5)
Plot size class = "pole"
IF (10.5 < medial diameter ≤ 16.5)
Plot size class = "small sawtimber"
IF (16.5 < medial diameter)
Plot size class = "large sawtimber"

WHERE:

$$\text{medial diameter} = \frac{\sum_{\substack{\text{tree} \\ \text{observations}}} \text{dbh}^3 \times \text{Stems per unit area}}{\sum_{\substack{\text{tree} \\ \text{observations}}} \text{dbh}^2 \times \text{Stems per unit area}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, DBH, Stems Per Unit Area

Other variables using overstory plot - plot size class: Percent Plots in Large Sawtimber, Percent Plots in Small Sawtimber, Percent Plots in Sapling, Percent Plots in Regeneration, Percent Open Plots, Number of Plot Size Classes, Percent Plots in Pole Size Class

Overstory Plot Variable - Pulpwood Value

Description: Dollar value of pulpwood products.

Valid values: Pulpwood value must be greater than or equal to zero.
Units: Dollars per acre or dollars per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Pulpwood value} \times \text{Stems per unit area}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Pulpwood Value, Living, Include Dead Trees in Timber Values

Other variables using overstory plot - pulpwood value: Pulpwood Value, Dollar Value

Overstory Plot Variable - Stem Bark Biomass

Description: Stem bark dry-weight biomass.

Valid values: Stem bark biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Stem bark biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stem Bark Biomass, Stems Per Unit Area, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - stem bark biomass: Stem Bark Biomass

Overstory Plot Variable - Stem Wood Biomass

Description: Stem wood dry-weight biomass.

Valid values: Stem wood biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.

NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Stem wood biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Stem Wood Biomass, Include Dead Trees in Timber Values, Living

Other variables using overstory plot - stem wood biomass: Stem Wood Biomass

Overstory Plot Variable - Total Biomass

Description: Total dry-weight biomass.

Valid values: Total biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Total biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Stems Per Unit Area, Total Biomass, Living, Include Dead Trees in Timber Values

Other variables using overstory plot - total biomass: Total Biomass

Tallied Overstory Variables

Tree Observation Variable - Cavity

Description: Presence of cavity in tree.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if the tree contains a cavity.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using tree observation - cavity: Dead Cavity Tree Present, Live Cavity Tree Present

Tree Observation Variable - Crown Class

Description: Crown class of tree.

Valid values: Crown class must be 1="open grown", 2="dominant", 3="codominant", 4="intermediate", or 5="suppressed".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Determine the position of the tree crown using the following codes: 1 = open grown—a tree that is free of competition and receives light on top and on all sides of the crown as a result of a very heavy thinning or being in an isolated, open-grown position; 2 = dominant—a tree with the crown extending above the general level of the main crown canopy and receiving full light from above and partly from the sides; 3 = codominant—a tree with a crown forming the general level of the main canopy, receiving full light from above but little from the sides; 4 = intermediate—a tree with a crown extending into the lower portions of the main crown canopy, but shorter than the codominants and receiving little direct light from above and none from the sides; 5 = suppressed—a tree whose crown is entirely below the general level of the canopy and receives no direct light from either above or the sides.
NED default value: None.
User-set default: Yes.
Calculated: No.

Tree Observation Variable - Crown Condition

Description: Percent of full crown living.

Valid values: Crown condition must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. An estimate of the tree crown's condition based upon the percent of crown that appears healthy (alive). Trees are in poor condition if more than 50% of their branches are dead; in fair condition if 25 to 50% of their branches are dead; and in good condition if less than 25% of their branches are dead.
NED default value: 100.0.
User-set default: Yes.
Calculated: No.

Tree Observation Variable - Custom Variable 1

Description: Custom variable 1.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to first pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - Custom Variable 2

Description: Custom variable 2.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to second pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - Custom Variable 3

Description: Custom variable 3.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to third pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - Custom Variable 4

Description: Custom variable 4.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to fourth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - Custom Variable 5

Description: Custom variable 5.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to fifth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - Custom Variable 6

Description: Custom variable 6.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to sixth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - DBH

Description: Diameter at breast height.

Valid values: DBH must be greater than or equal to 0.1.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the diameter at breast height for each tallied tree. Diameter can be entered in 1- or 2-inch classes or actual measurement down to a 1/10 inch. Do not mix diameter classes.
NED default value: 0.1.
User-set default: Yes.
Calculated: Yes.

The dbh will be set to the Overstory/Understory threshold.

NOTE: if the threshold is greater than the user-defined value
for dbh the calculation will over-write the user default

Variables used in calculation: Overstory/Understory DBH Threshold

Other variables using tree observation - dbh: Stems Per Unit Area in Seedlings, Stand medial DBH, Stems Per Unit Area in Saplings, Stand Stems Per Unit Area, Q Factor, Stand average DBH, Effective Age, Stand merchantable medial dbh, Stand Quadratic Mean DBH, Number of Big Trees Per Unit Area, Year of Maturity, Aboveground Biomass, Pulpwood Height, Sawtimber Height, Stand Relative Density, Relative Density of UGS, Relative Density of AGS, Stand Basal Area, Stand merchantable quadratic mean dbh, Length, Log Product, Coarse Root Biomass, Gross Board-foot Volume, Gross Cubic Volume, Foliage Biomass, Stem Bark Biomass, Basal Area in Saplings, Cluster medial Dbh, Cluster average Dbh, Cluster merchantable Quadratic DBH, Cluster Merchantable Medial DBH, Cluster Quadratic Mean DBH, Stem Wood Biomass, Tree Observation Stems Per Unit Area, Tree Observation Basal Area, Tree Observation Relative Density, Plot Size Class

Tree Observation Variable - Height Class

Description: Height class of observation.

Valid values: Height class must be greater than or equal to zero.
Units: Code.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the user-defined height class code that best represents the approximate height of the overstory observation.
NED default value: 0.
User-set default: Yes.
Calculated: No.

Tree Observation Variable - Living

Description: Tree is alive.

Units: Living/dead.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "yes" or "living" if the tree is alive.
NED default value: TRUE.
User-set default: Yes.
Calculated: No.

Other variables using tree observation - living: Dead Cavity Tree Present, Live Cavity Tree Present, Most Valuable Product, Timber Quality, Gross Tons Sawtimber, Stems Per Unit Area, Gross Sawtimber Cord Volume, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Basal Area, Gross Tons, Relative Density of UGS, Relative Density of AGS, Relative Density, Basal Area in Saplings, Basal Area of UGS, Basal Area of AGS, Net Tons Sawtimber, Net Sawtimber Cord Volume, Branch Biomass, Gross Board-foot Volume, Net Sawtimber Cubic Volume, Gross Sawtimber Cubic Volume, Net Pulpwood Cubic Volume, Gross Pulpwood Volume, Net Board-foot Volume, Net Tons Pulpwood, Gross Tons Pulpwood, Gross Pulpwood Cord Volume, Net Pulpwood Cord Volume, Total Biomass, Coarse Root Biomass, Foliage Biomass, Stem Bark Biomass, Hard Mast Present, Soft Mast, Plot Size Class, Canopy Closure, Gross Cord Volume, Net Tons, Net Cord Volume, Pulpwood Value, Board-foot Value, Aboveground Biomass, Stem Wood Biomass

Tree Observation Variable - Most Valuable Product

Description: Most valuable timber product obtained from tree.

Valid values: Most valuable product must be 1="veneer", 2="sawlog", 3="pulpwood", 4="boltwood", 6="firewood", 7="local use", 8="cull", 21="grade 1 sawlog", 22="grade 2 sawlog", 23="grade 3 sawlog", 24="subfactory sawlog", 31="chipped pulpwood", or 32="whole pulpwood".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. An estimate of the highest product or grade obtained in the tree. Enter one of the following codes: 1 = veneer—contains at least an 8-foot section that qualifies for veneer; 2 = sawlog—contains at least a 12-foot section that qualifies for grade 1 through 4 sawlog. If interested in the grade of the tree, you can also enter the following: 21 = grade 1 sawlog; 22 = grade 2 sawlog; 23 = grade 3 sawlog; 24 = subfactory sawlog (grade 4 sawlog); 3 = pulpwood—contains at least two contiguous 4-foot bolts with a minimum top diameter of 4 inches and at least 50% sound. You can also enter either of the following grades: 31 = chipped pulpwood; 32 = whole pulpwood; 4 = boltwood—has the same specification as pulpwood, but of species and quality that meets requirements of local boltwood producers; 5 = poles—meets specifications for local cabin log or pole markets; 6 = firewood—same specifications as pulpwood, except minimum top diameter inside bark is 1.0 inch; 7 = local use—a product used locally that does not meet any of the other products/grade. A local user definition; 8 = cull - tree less than 50% sound, or does not qualify for any of the products listed. A tree classified as cull is omitted from any volume calculations.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

IF there are no logs recorded THEN
  IF ('Living' = TRUE)
    'Most valuable product' = "sawlog"
  ELSE
    'Most valuable product' = "cull"
ELSE
  The most valuable 'Log product' is used.
    - Sawlog products always outrank pulpwood products.
    - If species timber prices exist, they are used to determine most valuable product
    - If prices are the same, products are ranked as follows (most valuable to least):

Sawtimber products	Pulpwood products
- veneer	- boltwood
- grade 1 sawlog	- local use
- grade 2 sawlog	- whole pulpwood
- sawlog	- pulpwood
- grade 3 sawlog	- local use
- subfactory sawlog	- whole pulpwood
	- pulpwood
	- chipped pulpwood
	- firewood

Variables used in calculation: Log Product, Living

Other variables using tree observation - most valuable product: Length, Timber Quality, Pulpwood Height, Sawtimber Height, Log Product

Tree Observation Variable - Pulpwood Defect

Description: Percent defect in pulpwood portion of tree.

Valid values: Pulpwood Defect must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the amount of defect in the pulpwood portion of the tree in percent. If data for pulp defect is not collected, then the default will set the variable at 0.0 and net volume will be 80% of gross volume in pulpwood.
NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Other variables using tree observation - pulpwood defect: Net Cubic Volume

Tree Observation Variable - Pulpwood Height

Description: Height of pulpwood portion of tree above the sawtimber height.

Valid values: Pulpwood height must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the portion of the tree above sawtimber height. For example, if the tree contains 32 feet of sawtimber, enter the portion above 32 feet that contains pulpwood products. If the tree does not contain any sawtimber, enter the merchantable pulpwood height. If no height is entered, the program will calculate an average height based on the diameter and age of the tree.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

IF there are user-entered logs

$$\text{Pulpwood height} = \sum_{logs} \text{Length}$$

only use logs where the 'Log product' is not "veneer", "sawlog", "grade 1 sawlog", "grade 2 sawlog", "grade 3 sawlog" or "subfactory sawlog"

ELSE IF the tree 'Most valuable product' is "cull"

Pulpwood height = 0.0

ELSE IF the tree species family 'Category' is "Gymnosperm"

AND the tree 'dbh' < 'Min dbh softwood pulp height'

Pulpwood height = 0.0

ELSE IF the tree species family 'Category' is not "Gymnosperm"

AND the tree 'dbh' < 'Min dbh hardwood pulp height'

Pulpwood height = 0.0

ELSE:

$$\text{Pulpwood height} = \left(\left(k_1 + \left(k_2 \times \log_{10}(\text{dbh})\right) + \left(\frac{k_3}{\text{dbh}}\right) + \left(\frac{k_4}{\text{Effective age}}\right)\right) \times 0.75\right) - \text{Sawlog height}$$

IF Pulpwood height < 'Smallest pulpwood log to estimate'

THEN Pulpwood height = 0.0

WHERE k_1, k_2, k_3 and k_4 depend on the 'Species'' as follows:

$k_1 = 57.738$, $k_2 = 23.401$, $k_3 = -245.90$, $k_4 = -623.81$ if the 'Species' is one of the following:

PLOC (American sycamore)
PRSE2 (black cherry)

$k_1 = 85.048$, $k_2 = 0.000$, $k_3 = -327.78$, $k_4 = -431.18$ if the 'Species' is one of the following:

ABIES (fir)
ABBA (balsam fir)
ABFR (Fraser fir)
JUCO6 (common juniper)
LADE2 (European larch)
LALA (tamarack)
PICEA (spruce)
PIAB (Norway spruce)
PIEN (Engelmann spruce)
PIGL (white spruce)
PIMA (black spruce)
PIPU (blue spruce)
PIRU (red spruce)
PINUS (pine)
PICL (sand pine)
PIEC2 (shortleaf pine)
PIEL (slash pine)
PIGL2 (spruce pine)
PIPA2 (longleaf pine)
PIPO (ponderosa pine)
PIPU5 (Table Mountain pine)
PIRE (red pine)
PIRI (pitch pine)
PISE (pond pine)
PIST (eastern white pine)
PISY (Scotch pine)
PITA (loblolly pine)
PINUS (pine)
FRAXI (ash)
FRAM2 (white ash)
FRNI (black ash)
FRPE (green ash)
FRPR (pumpkin ash)
FRQU (blue ash)
LITU (tuliptree)
MAAC (cucumber-tree)
POPUL (cottonwood)
POBA2 (balsam poplar)
PODE3 (eastern cottonwood)
POGR4 (bigtooth aspen)
POHE4 (swamp cottonwood)
PODEM (plains cottonwood)
POTR5 (quaking aspen)
POAL7 (white poplar)
POAN3 (narrowleaf cottonwood)

WHERE k_1, k_2, k_3 and k_4 depend on the 'Species'' as follows:

$k_1 = 74.428$, $k_2 = 0.000$, $k_3 = -296.67$, $k_4 = -257.30$ if the 'Species' is one of the following:

BETUL (birch)	BENI (river birch)
BEAL2 (yellow birch)	BEOC2 (water birch)
BELE (sweet birch)	BEPA (paper birch)

$k_1 = 78.544$, $k_2 = 0.000$, $k_3 = -293.04$, $k_4 = -428.41$ if the 'Species' is one of the following:

ACNI5 (black maple)	CEOC (common hackberry)
ACSA3 (sugar maple)	CLKE (Kentucky yellowwood)
AESCU (buckeye)	DIVI5 (common persimmon)
AEGL (Ohio buckeye)	JUCI (butternut)
AEFL (yellow buckeye)	JUNI (black walnut)
AESCU (buckeye)	QUVE (black oak)
CARYA (hickory)	ROPS (black locust)
CAAQ2 (water hickory)	ULMUS (elm)
CACO15 (bitternut hickory)	ULAL (winged elm)
CAGL8 (pignut hickory)	ULAM (American elm)
CAIL2 (pecan)	ULCR (cedar elm)
CALA21 (shellbark hickory)	ULPU (Siberian elm)
CAOV2 (shagbark hickory)	ULRU (slippery elm)
CATE9 (black hickory)	ULSE (September elm)
CAAL27 (mockernut hickory)	ULTH (rock elm)
CELTI (hackberry)	VEFO (tungoil tree)
CELA (sugarberry)	

$k_1 = 73.595$, $k_2 = 0.000$, $k_3 = -257.60$, $k_4 = -663.17$ if the 'Species' is one of the following:

FAGR (American beech)	SALIX (willow)
GLAQ (water locust)	SAAM2 (peachleaf willow)
GLTR (honeylocust)	SANI (black willow)
GYDI (Kentucky coffeetree)	SAER (Missouri River willow)

$k_1 = -97.007$, $k_2 = 114.990$, $k_3 = 179.44$, $k_4 = -656.09$ if the 'Species' is one of the following:

NED001 (commercial softwood)	PIVI2 (Virginia pine)
CHTH2 (Atlantic white cedar)	TADI2 (bald cypress)
JUNIP (juniper)	THOC2 (arborvitae)
JUSC2 (Rocky Mountain juniper)	TSUGA (hemlock)
JUVIS (southern redcedar)	TSCA (eastern hemlock)
JUVI (eastern redcedar)	TSCA2 (Carolina hemlock)
PIBA2 (jack pine)	

$k_1 = 85.378$, $k_2 = 0.000$, $k_3 = -323.44$, $k_4 = -472.69$ if the 'Species' is not listed above

This equation was developed from data provided by the Allegheny National Forest from their permanent sample plot data, and documented by Marquis (1977).

Sawlog height data from the ANF yields merchantable sawlog heights about 25% larger than the data used here from Hammermill. The Hammermill data seems to be more realistic of the proportion of the tree actually utilized for logs. thus, the ANF pulpwood height data is herein reduced by 25% as well, to make it correspond to the sawlog height utilization standards.

Variables used in calculation: Family Code, Smallest Pulpwood Log to Estimate, Min DBH for Softwood Pulp Height, Category, Effective Age, Most Valuable Product, DBH, Species, Min DBH Hardwood Pulp Height, Log Product, Length, Sawtimber Height

Other variables using tree observation - pulpwood height: Merchantable Height, Length, Log Product

Tree Observation Variable - Sawtimber Height

Description: Height of sawtimber portion of tree.

Valid values: Sawtimber Height must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the total height of sawtimber products in the tree in feet or meters; do not enter a count of logs or bolts. If no height is entered, the program will calculate an average height based on the diameter of the tree.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

IF there are user-entered logs

$$\text{Sawlog height} = \sum_{\text{logs}} \text{Length}$$

only use logs where the 'Log product' is "veneer", "sawlog", "grade 1 sawlog", "grade 2 sawlog", "grade 3 sawlog" or "subfactory sawlog"

ELSE IF the tree 'Most valuable product' is not "veneer", "sawlog", "grade 1 sawlog", "grade 2 sawlog", "grade 3 sawlog" or "subfactory sawlog"

Sawlog height = 0.0

ELSE IF the tree species family 'Category' is "Gymnosperm"
AND the tree 'dbh' < 'Min dbh softwood saw height'

Sawlog height = 0.0

ELSE IF the tree species family 'Category' is not "Gymnosperm"
AND the tree 'dbh' < 'Min dbh hardwood saw height'

Sawlog height = 0.0

ELSE:

$$\text{Sawlog height (in feet)} = \left(k_1 + \left(\frac{k_2}{\text{dbh}}\right)\right) \times 16.0$$

IF Sawlog height < 'Smallest sawlog to estimate'
THEN Sawlog height = 0.0

WHERE k_1 and k_2 depend on the 'Species'' as follows:

$k_1 = 2.7105$, $k_2 = -20.312$ if the 'Species' is one of the following:

PLOC (American sycamore)
PRSE2 (black cherry)

$k_1 = 2.5952$, $k_2 = -12.679$ if the 'Species' is one of the following:

FRAXI (ash)	PODE3 (eastern cottonwood)
FRAM2 (white ash)	POGR4 (bigtooth aspen)
FRNI (black ash)	POHE4 (swamp cottonwood)
FRPE (green ash)	PODEM (plains cottonwood)
FRPR (pumpkin ash)	POTR5 (quaking aspen)
FRQU (blue ash)	POAL7 (white poplar)
LITU (tuliptree)	POAN3 (narrowleaf cottonwood)
MAAC (cucumber-tree)	TILIA (basswood)
POPUL (cottonwood)	TIAM (American basswood)
POBA2 (balsam poplar)	TIAMH (American basswood)

$k_1 = 2.1224$, $k_2 = -13.371$ if the 'Species' is one of the following:

ACNI5 (black maple)	CEOC (common hackberry)
ACSA3 (sugar maple)	CLKE (Kentucky yellowwood)
AESCU (buckeye)	DIVI5 (common persimmon)
AEGL (Ohio buckeye)	JUCI (butternut)
AEFL (yellow buckeye)	JUNI (black walnut)
AESCU (buckeye)	QUVE (black oak)
CARYA (hickory)	ROPS (black locust)
CAAQ2 (water hickory)	ULMUS (elm)
CACO15 (bitternut hickory)	ULAL (winged elm)
CAGL8 (pignut hickory)	ULAM (American elm)
CAIL2 (pecan)	ULCR (cedar elm)
CALA21 (shellbark hickory)	ULPU (Siberian elm)
CAOV2 (shagbark hickory)	ULRU (slippery elm)
CATE9 (black hickory)	ULSE (September elm)
CAAL27 (mockernut hickory)	ULTH (rock elm)
CELTI (hackberry)	VEFO (tungoil tree)
CELA (sugarberry)	

WHERE k_1 and k_2 depend on the 'Species'' as follows:

$k_1 = 1.8099$, $k_2 = -12.036$ if the 'Species' is one of the following:

BETUL (birch)	GLAQ (water locust)
BEAL2 (yellow birch)	GLTR (honeylocust)
BELE (sweet birch)	GYDI (Kentucky coffeetree)
BENI (river birch)	SALIX (willow)
BEOC2 (water birch)	SAAM2 (peachleaf willow)
BEPA (paper birch)	SANI (black willow)
FAGR (American beech)	SAER (Missouri River willow)

$k_1 = 3.5473$, $k_2 = -38.741$ if the 'Species' is one of the following:

NED001 (commercial softwood)	PIVI2 (Virginia pine)
CHTH2 (Atlantic white cedar)	TADI2 (bald cypress)
JUNIP (juniper)	THOC2 (arborvitae)
JUSC2 (Rocky Mountain juniper)	TSUGA (hemlock)
JUVIS (southern redcedar)	TSCA (eastern hemlock)
JUVI (eastern redcedar)	TSCA2 (Carolina hemlock)
PIBA2 (jack pine)	

$k_1 = 2.3042$, $k_2 = -16.806$ if the 'Species' is one of the following:

QUERC (oak)	QUMI (swamp chestnut oak)
QUAL (white oak)	QUMU (chinkapin oak)
QUBI (swamp white oak)	QUNI (water oak)
QUCO2 (scarlet oak)	QUTE (Texas red oak)
QUSIS (bastard oak)	QUPA2 (pin oak)
QUEL (northern pin oak)	QUPH (willow oak)
QUFA (southern red oak)	QUPR2 (chestnut oak)
QUPA5 (cherrybark oak)	QURU (northern red oak)
QUIL (bear oak)	QUSH (Shumard's oak)
QUIM (shingle oak)	QUST (post oak)
QULA2 (turkey oak)	QUSI2 (bottomland post oak)
QULA3 (laurel oak)	QUVI (live oak)
QULY (overcup oak)	QUIN (bluejack oak)
QUMA2 (bur oak)	QUBE5 (scrub oak)
QUMA3 (blackjack oak)	

$k_1 = 2.673$, $k_2 = -16.635$ if the 'Species' is one of the following:

ABIES (fir)	PICL (sand pine)
ABBA (balsam fir)	PIEC2 (shortleaf pine)
ABFR (Fraser fir)	PIEL (slash pine)
JUCO6 (common juniper)	PIGL2 (spruce pine)
LADE2 (European larch)	PIPA2 (longleaf pine)
LALA (tamarack)	PIPU5 (Table Mountain pine)
PICEA (spruce)	PIRE (red pine)
PIAB (Norway spruce)	PIRI (pitch pine)
PIEN (Engelmann spruce)	PISE (pond pine)
PIGL (white spruce)	PIST (eastern white pine)
PIMA (black spruce)	PISY (Scotch pine)
PIPU (blue spruce)	PITA (loblolly pine)
PIRU (red spruce)	PINUS (pine)
PINUS (pine)	

$k_1 = 2.3382$, $k_2 = -16.578$ if the 'Species' is not listed above

This equation was developed from data provided by Hammermill paper company and published by Marquis et al. 1984.

Variables used in calculation: Min DBH For Softwood Saw Height, Min DBH Hardwood Saw Height, Category, Family Code, Most Valuable Product, DBH, Species, Length, Log Product

Other variables using tree observation - sawtimber height: Merchantable Height, Log Product, Length, Pulpwood Height

Tree Observation Variable - Sawtimber Defect

Description: Percent defect in sawtimber portion of tree.

Valid values: Sawtimber defect must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the amount of defect in the sawtimber portion in percent. If data for sawtimber defect is not collected, the default is set at 0.0 and gross board-foot volume and net board-foot volume will be equal.
NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Other variables using tree observation - sawtimber defect: Net Cubic Volume, Net Board-foot Volume

Tree Observation Variable - Species

Description: Tree species.

Units: Symbol.
Variable type: Species.

Editable by user: Yes.
Tallied by user: Yes. For every tallied tree, enter the tree species using either USDA PLANTS Database symbol (such as ACSA3 for sugar maple), the 3-digit FIA code (such as 318 for sugar maple), or a user-defined code (such as SM for sugar maple).
NED default value: NED999.
User-set default: No.
Calculated: No.

Other variables using tree observation - species: Effective Age, Rare Plants Present, Exotic Plants Present, Percent Basal Area Evergreen, Percent Basal Area Commercial, Percent Basal Area Conifer, Percent Basal Area Hardwoods, Percent Basal Area High Value, Trees with Fruits and Nuts, Trees with Showy Flowers, Fall Color Trees, Year of Maturity, Forest Type, Aboveground Biomass, Pulpwood Height, Sawtimber Height, Number of Big Trees Per Unit Area, Length, Log Product, Net Tons, Gross Tons, Net Cord Volume, Dollar Value, Gross Board-foot Volume, Foliage Biomass, Stem Bark Biomass, Coarse Root Biomass, Stem Wood Biomass, Gross Cord Volume, Relative Density, Soft Mast, Hard Mast Present

Tree Observation Variable - Stem Count

Description: Count of trees with identical characteristics on this plot.

Valid values: Stem count must be greater than or equal to zero.
Units: Count.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the total number of identical trees of the same species, dbh, quality, etc. on the plot and described in a single observation. It is not necessary to combine similar observations.
NED default value: 1.0.
User-set default: Yes.
Calculated: No.

Other variables using tree observation - stem count: Stems Per Unit Area

Tree Observation Variable - Timber Quality

Description: Quality of tree for timber production.

Valid values: Timber quality must be 1="AGS", 2="UGS", or 3="Crop".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. A determination of whether the tallied tree will produce a sawtimber product. AGS = Acceptable Growing Stock for timber—capable of producing sawtimber when it reaches appropriate size, and expected to live at least 15 years; UGS = Unacceptable Growing Stock for timber—not capable of producing sawtimber at any time in future and/or not expected to survive for 15 years; Crop tree—an extremely desirable acceptable growing stock tree.
NED default value: AGS.
User-set default: Yes.
Calculated: Yes.

```
IF ('Living' = FALSE) OR ('Most valuable product' = "cull")
      Timber = "UGS"
ELSE
      Timber = "AGS"
```

Variables used in calculation: Living, Most Valuable Product

Other variables using tree observation - timber quality: Relative Density of AGS, Basal Area of UGS, Basal Area of AGS, Relative Density of UGS

Tree Observation Variable - Height of Plant

Description: Total height of tree.

Valid values: Height of plant must be greater than or equal to 4.5 feet.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the height of the tree from the ground to the tip of the leader or top of the crown. **Note:** This is a total height variable. If you want to record merchantable height, use the sawlog height and pulpwood height variables.
NED default value: None.
User-set default: Yes.
Calculated: No.

Tree Observation Variable - Tree ID

Description: Observation identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the identification name or number of the overstory observation.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

Concatenation of the 'Plot ID' with a
colon with the value of OVER_OBS+1

Variables used in calculation: Plot ID

Tree Observation Variable - Visually Interesting

Description: Visually interesting tree.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. If the tree is of visual interest, enter "yes".
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using tree observation - visually interesting: Interesting Tree Present

Overstory Variables

Tree Observation Variable - Aboveground Biomass

Description: Aboveground dry-weight biomass of the tree.

Valid values: Aboveground biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4
biomass = 0.0
ELSE
biomass = $\frac{\text{Exp}(\beta_1 + (\beta_2 \times \ln(\text{dbh} \times 2.54)))}{0.4535924}$
where:

NOTE: the original equations are in metric, where dbh is centimeters and the resulting biomass is in kilograms.

β_1 = -2.2094 and β_2 = 2.3867 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -1.9123 and β_2 = 2.3651 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -2.4800 and β_2 = 2.4835 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

β_1 = -2.0127 and β_2 = 2.4342 if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

β_1 = -2.0366 and β_2 = 2.2592 if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

β_1 = -2.2304 and β_2 = 2.4435 if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

β_1 = -2.5384 and β_2 = 2.4814 if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

β_1 = -2.5356 and β_2 = 2.4349 if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

β_1 = -2.0773 and β_2 = 2.3323 if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

β_1 = -0.7152 and β_2 = 1.7029 if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: DBH, Species

Other variables using tree observation - aboveground biomass: Foliage Biomass, Total Biomass, Stem Wood Biomass, Stem Bark Biomass, Coarse Root Biomass, Aboveground Biomass, Branch Biomass

Tree Observation Variable - Basal Area

Description: Basal area.

Valid values: Basal area must be greater than or equal to zero.
Units: Square feet or square meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF dbh < 1.0

Basal area = 0.0

ELSE

$$\text{Basal area} = \text{dbh}^2 \times \left(\frac{\pi}{(144 * 4)} \right)$$

Variables used in calculation: DBH

Other variables using tree observation - basal area: Percent Basal Area Evergreen, Percent Basal Area Conifer, Percent Basal Area Hardwoods, Percent Basal Area Commercial, Percent Basal Area High Value, Trees with Fruits and Nuts, Trees with Showy Flowers, Fall Color Trees, Basal Area of UGS, Basal Area of AGS, Basal Area in Saplings, Year of Maturity, Forest Type, Basal Area, Site Index Species

Tree Observation Variable - Branch Biomass

Description: Branch dry-weight biomass of the tree.

Valid values: Branch biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Aboveground biomass - (Foliage biomass + Stem bark biomass + Stem wood biomass)

Variables used in calculation: Aboveground Biomass, Stem Wood Biomass, Foliage Biomass, Stem Bark Biomass

Other variables using tree observation - branch biomass: Branch Biomass

Tree Observation Variable - Board-foot Value

Description: Dollar value of sawtimber products from tree.

Valid values: Board-foot value must be greater than or equal to zero.
Units: Dollars.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$\sum_{\text{logs}}$ Dollar value

Only use logs that are sawlog products

Variables used in calculation: Dollar Value, Log Product

Other variables using tree observation - board-foot value: Dollar Value, Board-foot Value

Tree Observation Variable - Coarse Root Biomass

Description: Coarse root dry-weight biomass of the tree.

Valid values: Coarse root biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4
biomass = 0.0
ELSE
biomass = 'Aboveground biomass' × $\text{Exp}\left(\beta_1 + \left(\frac{\beta_2}{\text{dbh} \times 2.54}\right)\right)$
where:

NOTE: the original equations are in metric, where dbh is centimeters

β_1 = -1.6911 and β_2 = 0.8160 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -1.6911 and β_2 = 0.8160 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -1.6911 and β_2 = 0.8160 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

$\beta_1 = -1.6911$ and $\beta_2 = 0.8160$ if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: Aboveground Biomass, DBH, Species

Other variables using tree observation - coarse root biomass: Total Biomass, Coarse Root Biomass

Tree Observation Variable - User Comments

Description: User comments/notes.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - Crown Ratio

Description: Crown ratio of the tree - simulated data only.

Valid values: Crown ratio must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - Foliage Biomass

Description: Foliage dry-weight biomass of the tree.

Valid values: Foliage biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4
biomass = 0.0
ELSE
biomass = 'Aboveground biomass' × $\mathrm{Exp}\left(\beta_1 + \left(\frac{\beta_2}{\mathrm{dbh} \times 2.54}\right)\right)$
where:

NOTE: the original equations are in metric, where dbh is centimeters

β_1 = -4.0813 and β_2 = 5.8816 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -4.0813 and β_2 = 5.8816 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -4.0813 and β_2 = 5.8816 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

$\beta_1 = -4.0813$ and $\beta_2 = 5.8816$ if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

$\beta_1 = -2.9584$ and $\beta_2 = 4.4766$ if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

$\beta_1 = -2.9584$ and $\beta_2 = 4.4766$ if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

$\beta_1 = -2.9584$ and $\beta_2 = 4.4766$ if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

$\beta_1 = -2.9584$ and $\beta_2 = 4.4766$ if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

$\beta_1 = -2.9584$ and $\beta_2 = 4.4766$ if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

$\beta_1 = -2.9584$ and $\beta_2 = 4.4766$ if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: Aboveground Biomass, Species, DBH

Other variables using tree observation - foliage biomass: Foliage Biomass, Branch Biomass

Tree Observation Variable - Gross Board-foot Volume

Description: Gross board-foot volume (unadjusted).

Valid values: Gross board-foot volume must be greater than or equal to zero.
Units: Board feet.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\text{logs}} \text{Gross board-foot volume}$$

Variables used in calculation: Gross Board-foot Volume

Other variables using tree observation - gross board-foot volume: Gross Board-foot Volume

Tree Observation Variable - Gross Cord Volume

Description: Gross whole-tree cord volume.

Valid values: Gross cord volume must be greater than or equal to zero.
Units: Cords.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\text{logs}} \text{Gross cord volume}$$

Variables used in calculation: Gross Cord Volume

Other variables using tree observation - gross cord volume: Gross Cord Volume

Tree Observation Variable - Gross Cubic Volume

Description: Gross whole-tree cubic volume.

Valid values: Gross cubic volume must be greater than or equal to zero.
Units: Cubic feet or cubic meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Gross pulpwood cubic volume + Gross sawlog cubic volume

Variables used in calculation: Gross Sawtimber Cubic Volume, Gross Pulpwood Cubic Volume

Tree Observation Variable - Gross Pulpwood Cord Volume

Description: Gross cord volume excluding volume in sawtimber.

Valid values: Gross pulpwood cord volume must be greater than or equal to zero.
Units: Cords.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\text{logs}} \text{Gross cord volume}$$

Only use logs that are pulpwood products

Variables used in calculation: Gross Cord Volume, Log Product

Other variables using tree observation - gross pulpwood cord volume: Gross Pulpwood Cord Volume

Tree Observation Variable - Gross Pulpwood Cubic Volume

Description: Gross cubic volume excluding volume in sawtimber.

Valid values: Gross pulpwood cubic volume must be greater than or equal to zero.
Units: Cubic feet or cubic meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Gross cubic volume}$$

Only use logs that are pulpwood products

Variables used in calculation: Gross Cubic Volume, Log Product

Other variables using tree observation - gross pulpwood cubic volume: Gross Pulpwood Volume, Gross Cubic Volume

Tree Observation Variable - Gross Sawtimber Cubic Volume

Description: Gross cubic volume in sawtimber.

Valid values: Gross sawtimber cubic volume must be greater than or equal to zero.
Units: Cubic feet or cubic meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Gross cubic volume}$$

Only use logs that are sawlog products

Variables used in calculation: Log Product, Gross Cubic Volume

Other variables using tree observation - gross sawtimber cubic volume: Gross Cubic Volume, Gross Sawtimber Cubic Volume

Tree Observation Variable - Gross Sawtimber Cord Volume

Description: Gross cord volume in sawtimber portion of tree.

Valid values: Gross Sawtimber Cord Volume must be greater than or equal to zero.
Units: Cords.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Gross cord volume}$$

Only use logs that are sawlog products

Variables used in calculation: Gross Cord Volume, Log Product

Other variables using tree observation - gross sawtimber cord volume: Gross Sawtimber Cord Volume

Tree Observation Variable - Gross Tons

Description: Gross whole-tree tons.

Valid values: Gross tons must be greater than or equal to zero.
Units: Tons or tonnes.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Gross tons}$$

Variables used in calculation: Gross Tons

Other variables using tree observation - gross tons: Gross Tons

Tree Observation Variable - Gross Tons Pulpwood

Description: Gross tons excluding sawtimber.

Valid values: Gross tons pulpwood must be greater than or equal to zero.
Units: Tons or tonnes.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.

User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Gross tons}$$

Only use logs that are pulpwood products

Variables used in calculation: Gross Tons, Log Product

Other variables using tree observation - gross tons pulpwood: Gross Tons Pulpwood

Tree Observation Variable - Gross Tons Sawtimber

Description: Gross tons in sawtimber portion of tree.

Valid values: Gross tons sawtimber must be greater than or equal to zero.
Units: Tons or tonnes.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Gross tons}$$

Only use logs that are sawlog products

Variables used in calculation: Log Product, Gross Tons

Other variables using tree observation - gross tons sawtimber: Gross Tons Sawtimber

Tree Observation Variable - Maximum Crown Width

Description: Maximum width of the crown - simulated data only.

Valid values: Maximum crown width must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Tree Observation Variable - Merchantable Height

Description: Merchantable height of tree.

Valid values: Merchantable height must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Sawlog height + Pulpwood height

Variables used in calculation: Pulpwood Height, Sawtimber Height

Tree Observation Variable - Net Board-foot Volume

Description: Net board-foot volume.

Valid values: Net board-foot volume must be greater than or equal to zero.
Units: Board feet.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\text{logs}} \text{Net board-foot volume}$$

Variables used in calculation: Net Board-foot Volume

Other variables using tree observation - net board-foot volume: Net Board-foot Volume

Tree Observation Variable - Net Cord Volume

Description: Net whole-tree cord volume.

Valid values: Net cord volume must be greater than or equal to zero.
Units: Cords.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Net cord volume}$$

Variables used in calculation: Net Cord Volume

Other variables using tree observation - net cord volume: Net Cord Volume

Tree Observation Variable - Net Cubic Volume

Description: Net whole-tree cubic volume.

Valid values: Net cubic volume must be greater than or equal to zero.
Units: Cubic feet or cubic meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\text{Net pulpwood volume} + \text{Net sawlog cubic volume}$$

Variables used in calculation: Net Sawtimber cubic volume, Net Pulpwood Volume

Tree Observation Variable - Net Pulpwood Cord Volume

Description: Net cord volume excluding volume in sawtimber.

Valid values: Net pulpwood cord volume must be greater than or equal to zero.
Units: Cords.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Net cord volume}$$

Only use logs that are pulpwood products

Variables used in calculation: Net Cord Volume, Log Product

Other variables using tree observation - net pulpwood cord volume: Net Pulpwood Cord Volume

Tree Observation Variable - Net Pulpwood Volume

Description: Net cubic volume excluding volume in sawtimber.

Valid values: Net pulpwood volume must be greater than or equal to zero.
Units: Cubic feet or cubic meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Net cubic volume}$$

Only use logs that are pulpwood products

Variables used in calculation: Net Cubic Volume, Log Product

Other variables using tree observation - net pulpwood volume: Net Pulpwood Cubic Volume, Net Cubic Volume

Tree Observation Variable - Net Sawtimber Cord Volume

Description: Net cord volume in sawtimber portion of tree.

Valid values: Net sawtimber cord volume must be greater than or equal to zero.
Units: Cords.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Net cord volume}$$

Only use logs that are sawlog products

Variables used in calculation: Net Cord Volume, Log Product

Other variables using tree observation - net sawtimber cord volume: Net Sawtimber Cord Volume

Tree Observation Variable - Net Sawtimber cubic volume

Description: Net cubic volume in sawtimber.

Valid values: Net sawtimber cubic volume must be greater than or equal to zero.
Units: Cubic feet or cubic meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Net cubic volume}$$

Only use logs that are sawlog products

Variables used in calculation: Log Product, Net Cubic Volume

Other variables using tree observation - net sawtimber cubic volume: Net Cubic Volume, Net Sawtimber Cubic Volume

Tree Observation Variable - Net Tons

Description: Net whole-tree tons.

Valid values: Net tons must be greater than or equal to zero.
Units: Tons or tonnes.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Net tons}$$

Variables used in calculation: Net Tons

Other variables using tree observation - net tons: Net Tons

Tree Observation Variable - Net Tons Pulpwood

Description: Net tons excluding sawtimber.

Valid values: Net tons pulpwood must be greater than or equal to zero.
Units: Tons or tonnes.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Net tons}$$

Only use logs that are pulpwood products

Variables used in calculation: Log Product, Net Tons

Other variables using tree observation - net tons pulpwood: Net Tons Pulpwood

Tree Observation Variable - Net Tons Sawtimber

Description: Net tons in sawtimber portion of tree.

Valid values: Net tons sawtimber must be greater than or equal to zero.
Units: Tons or tonnes.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Net tons}$$

Only use logs that are sawlog products

Variables used in calculation: Net Tons, Log Product

Other variables using tree observation - net tons sawtimber: Net Tons Sawtimber

Tree Observation Variable - Pulpwood Value

Description: Dollar value of pulpwood products from tree.

Valid values: Pulpwood value must be greater than or equal to zero.
Units: Dollars.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{logs} \text{Dollar value}$$

Only use logs that are pulpwood products

Variables used in calculation: Log Product, Dollar Value

Other variables using tree observation - pulpwood value: Pulpwood Value, Dollar Value

Tree Observation Variable - Relative Density

Description: Relative density contribution of individual trees using the tree-area ratio concept as described in Stout et al. (1987). Coefficients for individual species or species groups, listed below, were developed from their respective stocking guides identified in the references.

Valid values: Relative density must be greater than or equal to zero.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF dbh < 1.0
    Relative density = 0.0
ELSE

$$\text{Relative density} = \left(k_1 + \left(k_2 \times \text{dbh}\right) + \left(k_3 \times \text{dbh}^2\right)\right)$$

where k_1, k_2 and k_3 depend on the species:

k_1= 0.0077041, k_2= 0.00626130, k_3= 0.00384800 if FIA code is 531,371,318 (Beech, Y Birch, S Maple)
k_1=-0.0197010, k_2= 0.02164000, k_3= 0.00031039 if FIA code is 12,90-98 (Balsam Fir, Spruce)
k_1= 0.0279800, k_2= 0.00783220, k_3= 0.00174670 if FIA code is 129 (White Pine)
k_1=-0.0254180, k_2= 0.01475300, k_3= 0.00162290 if FIA code is 125 (Red Pine)
k_1=-0.0115280, k_2= 0.00085458, k_3= 0.00264390 if FIA code is 261 (Hemlock)
k_1= 0.0442830, k_2= 0.01294600, k_3= 0.00587480 if FIA code is 375 (P. Birch)
k_1= 0.0279370, k_2= 0.01545200, k_3= 0.00087100 if FIA code is 541,621,762 (W Ash, Cherry, Y Poplar)
k_1= 0.0325890, k_2= 0.00743860, k_3= 0.00383380 if FIA code is 544,742,972 (G. Ash, Cottonwood, A Elm)
k_1= 0.0308780, k_2= 0.01805800, k_3= 0.00423210 if FIA code is 602 (Black Walnut)
k_1=-0.0024055, k_2= 0.00494220, k_3= 0.00226670 if FIA code is 241 (W. Cedar)
k_1=-0.0053402, k_2= 0.00737650, k_3= 0.00432100 if FIA code is 833 (Red Oak)
k_1= 0.0028020, k_2= 0.01188100, k_3= 0.00354600 if FIA code is 400-409,800-850 (Hickories, other Oaks)
k_1=-0.0081504, k_2= 0.00081670, k_3= 0.00280480 if FIA code is 951 (A Basswood)
k_1= 0.0041871, k_2= 0.01255100, k_3= 0.00237960 if FIA code is 746,743 (Q Aspen, B Aspen)
k_1=-0.0721970, k_2= 0.03416300, k_3= 0.00102220 for any softwoods not listed elsewhere (FIA < 300)
k_1=-0.0179790, k_2= 0.02142500, k_3= 0.00171100 for any hardwoods not listed elsewhere (FIA ≥ 300)

If the above calculation is less than zero, the relative density will be set to zero

The original formula was based on an A-line of 80% for White Pine, so if the FIA code is129 (White Pine) the calculated value is multiplied by 0.8 (Philbrook et al. 1973).

Variables used in calculation: Species, DBH

Other variables using tree observation - relative density: Relative Density of UGS, Relative Density Of AGS, Canopy Closure, Relative Density

Tree Observation Variable - Stem Bark Biomass

Description: Stem bark dry-weight biomass of tree.

Valid values: Stem bark biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4

biomass = 0.0

ELSE

biomass = 'Aboveground biomass' × $\mathrm{Exp}\left(\beta_1 + \left(\frac{\beta_2}{\mathrm{dbh} \times 2.54}\right)\right)$

where:

NOTE: the original equations are in metric, where dbh is centimeters

β_1 = -2.0129 and β_2 = -1.6805 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -2.0129 and β_2 = -1.6805 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -2.0129 and β_2 = -1.6805 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

β_1 = -2.0129 and β_2 = -1.6805 if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: Aboveground Biomass, Species, DBH

Other variables using tree observation - stem bark biomass: Stem Bark Biomass, Branch Biomass

Tree Observation Variable - Stem Wood Biomass

Description: Stem wood dry-weight biomass of the tree.

Valid values: Stem wood biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4
biomass = 0.0
ELSE
biomass = 'Aboveground biomass' × $\mathrm{Exp}\left(\beta_1 + \left(\frac{\beta_2}{\mathrm{dbh} \times 2.54}\right)\right)$
where:

NOTE: the original equations are in metric, where dbh is centimeters

β_1 = -0.3065 and β_2 = -5.4240 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -0.3065 and β_2 = -5.4240 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -0.3065 and β_2 = -5.4240 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

$\beta_1 = -0.3065$ and $\beta_2 = -5.4240$ if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

$\beta_1 = -0.3737$ and $\beta_2 = -1.8055$ if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

$\beta_1 = -0.3737$ and $\beta_2 = -1.8055$ if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

$\beta_1 = -0.3737$ and $\beta_2 = -1.8055$ if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

$\beta_1 = -0.3737$ and $\beta_2 = -1.8055$ if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

$\beta_1 = -0.3737$ and $\beta_2 = -1.8055$ if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

$\beta_1 = -0.3737$ and $\beta_2 = -1.8055$ if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: Aboveground Biomass, Species, DBH

Other variables using tree observation - stem wood biomass: Stem Wood Biomass, Branch Biomass

Tree Observation Variable - Stems Per Unit Area

Description: Number of stems per unit area represented by this observation.

Valid values: Stems per unit area must be between 0 and 99999.
Units: Stems per acre or stems per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

If Overstory inventory type = "Prism points"

$$\left(\frac{\text{Overstory prism BAF}}{\text{dbh}^2 \times \left(\frac{\pi}{144 * 4} \right)} \right) \times \text{Stem count}$$

If Overstory inventory type = "Fixed area"

$$\left(\frac{1.0}{\text{Overstory plot size}} \right) \times \text{Stem count}$$

Note: this is only calculated for inventory snapshots

Variables used in calculation: Overstory Prism BAF, Overstory Plot Size, Overstory Inventory Type, Stem Count, DBH

Other variables using tree observation - stems per unit area: Forest Type, Stems Per Unit Area in Seedlings, Stems Per Unit Area in Saplings, Stems Per Unit Area, Q Factor, Stand Average DBH, Stand Merchantable Medial dbh, Stand Quadratic Mean DBH, Stand Medial DBH, Effective Age, Percent Basal Area Evergreen, Percent Basal Area Conifer, Percent Basal Area Hardwoods, Relative Density of AGS, Relative Density, Percent Basal Area High Value, Percent Basal Area Commercial, Basal Area In Saplings, Trees with Showy Flowers, Fall Color Trees, Trees with Fruits and Nuts, Number Of Big Trees Per Unit Area, Basal Area Of UGS, Canopy Closure, Gross Board-foot Volume, Gross Pulpwood Volume, Net Pulpwood Cubic Volume, Net Board-foot Volume, Stem Bark Biomass, Total Biomass, Stem Wood Biomass, Coarse Root Biomass, Aboveground Biomass, Foliage Biomass, Gross Sawtimber Cord Volume,

Basal Area, Gross Tons, Relative Density of UGS, Gross Tons Sawtimber, Stand merchantable quadratic mean dbh, Net Tons Sawtimber, Net Sawtimber Cord Volume, Branch Biomass, Net Sawtimber Cubic Volume, Gross Sawtimber Cubic Volume, Board-foot Value, Pulpwood Value, Basal Area Of AGS, Cluster average DBH, Net Tons Pulpwood, Net Pulpwood Cord Volume, Gross Tons Pulpwood, Cluster Medial DBH, Cluster Merchantable Quadratic Mean DBH, Cluster Merchantable Medial DBH, Cluster Quadratic Mean DBH, Gross Pulpwood Cord Volume, Net Tons, Net Cord Volume, Gross Cord Volume, Plot Size Class

Tree Observation Variable - Total Biomass

Description: Total dry-weight biomass of the tree.

Valid values: Total Biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Aboveground biomass + Coarse root biomass

Variables used in calculation: Coarse Root Biomass, Aboveground Biomass

Other variables using tree observation - total biomass: Total Biomass

Tree Observation Variable - Dollar Value

Description: Dollar value of timber products from tree.

Valid values: Dollar value must be greater than or equal to zero.
Units: Dollars.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Pulpwood value + Board-foot value

Variables used in calculation: Board-foot Value, Pulpwood Value

Tallied Log Variables

Log ID Variable

Description: Log identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the identification name or number of the merchantable log section. Log ID, Log Length, and Log Product are variables to record if you itemize the product and quality of each log within the tree. These variables are used in place of sawlog height and pulpwood height.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

The first log:
"butt"
All other logs:
Concatenation of "log" with the value of LOG+1

Log Variable - Length

Description: Length of log.

Valid values: Length must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the log length.
NED default value: 0.
User-set default: Yes.
Calculated: Yes.

See:
NED-2 User's Guide, "Calculating logs from merchantable height"

Variables used in calculation: Most Valuable Product, Hardwood or Softwood, Species, Smallest Pulpwood Log to Estimate, Pulpwood Height, Min DBH Hardwood Pulp Height, Min DBH for Softwood Pulp Height, Min DBH Hardwood Saw Height, Min DBH for Softwood Saw Height, DBH, Smallest Sawtimber to Estimate, Sawtimber Height

Other variables using log - length: Gross Board-foot Volume, Gross Cubic Volume, Sawtimber Height, Pulpwood Height

Log Product Variable

Description: Timber product obtained from log.

Valid values: Log product must be 1="veneer", 2="sawlog", 21="grade 1 sawlog", 22="grade 2 sawlog", 23="grade 3 sawlog", 24="subfactory sawlog", 3="pulpwood", 31="chipped pulpwood", 32="whole pulpwood", 4="boltwood", 6="firewood", 7="local use", or 8="cull".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. An estimate of the highest product or grade obtained in the log. Enter one of the following codes: 1 = veneer— contains at least an 8-foot section that qualifies for veneer; 2 = sawlog— contains at least a 12-foot section that qualifies for grade 1 through 4 sawlog. If interested in the grade of the tree, you can also enter the following: 21 = grade 1 sawlog; 22 = grade 2 sawlog; 23 = grade 3 sawlog; 24 = subfactory sawlog (grade 4 sawlog); 3 = pulpwood—contains at least two contiguous 4-foot bolts with a minimum top diameter of 4 inches and at least 50% sound. You can also enter either of the following grades: 31 = chipped pulpwood; 32 = whole pulpwood; 4 = boltwood—has the same specification as pulpwood, but of species and quality that meets requirements of local boltwood producers; 5 = poles—meets specifications for local cabin log or pole markets; 6 = firewood—same specifications as pulpwood, except minimum top diameter inside bark is 1.0 inch; 7 = local use—a product used locally that does not meet any of the other products/grade. A local user definition; 8 = cull—tree less than 50% sound, or does not qualify for any of the products listed. A log classified as cull is omitted from any volume calculations.
NED default value: Pulpwood.
User-set default: Yes.
Calculated: Yes.

See:
"Calculating Logs from Merchantable Height."

Variables used in calculation: Species, Smallest Pulpwood Log to Estimate, Hardwood or Softwood, Most Valuable Product, Sawtimber Height, Smallest Sawtimber to Estimate, DBH, Min DBH for Softwood Saw Height, Min DBH Hardwood Saw Height, Min DBH for Softwood Pulp Height, Min DBH Hardwood Pulp Height, Pulpwood Height

Other variables using log product: Net Pulpwood Volume, Gross Pulpwood Cubic Volume, Most Valuable Product, Net Tons Sawtimber, Net Sawtimber Cord Volume, Gross Tons Sawtimber, Gross Sawtimber Cord Volume, Gross Board-foot Volume, Gross Cubic Volume, Pulpwood Height, Net Sawtimber cubic volume, Gross Sawtimber Cubic Volume, Pulpwood Value, Board-foot Value, Sawtimber Height, Net Tons Pulpwood, Gross Tons Pulpwood, Net Pulpwood Cord Volume, Gross Pulpwood Cord Volume

Log Variables

Log Variable - Dollar Value

Description: Dollar value of timber product from log per unit area.

Valid values: Dollar Value must be greater than or equal to zero.
Units: Dollars.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'Net cubic volume' = 0 AND 'Net board-foot volume' = 0
    'Dollar value' = 0.0

ELSE IF 'Net board-foot volume' > 0.0
    'Dollar value' = Net board-foot volume $\times \frac{\text{price}}{1000.0}$
    WHERE price is:
        'Price for veneer' IF 'Product' = "veneer"
        'Price for grade 2 sawlogs' IF 'Product' = "sawlog"
        'Price for grade 1 sawlogs' IF 'Product' = "grade 1 sawlog"
        'Price for grade 2 sawlogs' IF 'Product' = "grade 2 sawlog"
        'Price for grade 3 sawlogs' IF 'Product' = "grade 3 sawlog"
        'Price for subfactory sawlogs' IF 'Product' = "subfactory sawlog"

ELSE IF 'Net cubic-foot volume' > 0.0
    'Dollar value' = Net cubic-foot volume $\times \frac{\text{price}}{100.0}$
    WHERE price is:
        'Price for whole pulpwood' IF 'Product' = "pulpwood"
        'Price for whole pulpwood' IF 'Product' = "whole pulpwood"
        'Price for chipped pulpwood' IF 'Product' = "chipped pulpwood"
        'Price for boltwood' IF 'Product' = "boltwood"
        'Price for firewood' IF 'Product' = "firewood"
        'Price for local use' IF 'Product' = "local use"

The 'Species' of the tree is used to find the correct product price

Variables used in calculation: Price for Grade 3 Sawtimber, Price for Grade 2 Sawtimber, Price for Grade 1 Sawtimber, Price for Veneer, Species, Net Cubic Volume, Net Board-foot Volume, Price for Chipped Pulpwood, Price for Subfactory Sawtimber, Price for Whole Pulpwood, Price for Local Use, Price for Firewood, Price for Boltwood

Other variables using log - dollar value: Board-foot Value, Pulpwood Value

Log Variable - Gross Board-foot Volume

Description: Gross board-foot volume.

Valid values: Gross board-foot volume must be greater than or equal to zero.
Units: Board feet.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

If the 'Log product' is "cull" then volume = 0.0,
If the tree's dbh < minimum top diameter for board-foot volume then volume = 0.0,
Otherwise, gross board-foot volume of a log is calculated depending on the log length, as follows:

- If the Length is < 16 feet, see the formula for board-foot volume of smaller logs (Wiant and Castaneda 1977).
- If the Length is ≥ 16 feet, see the formula for board-foot volume of larger logs (Scrivani 1989). For larger logs, the original calculation was meant to calculate the total volume of the tree. In order to calculate the volume of an individual log, we calculate the total tree volume to the top of the log and subtract the volume in the tree below the log.

A board-foot correction factor is applied to the calculated gross board-foot volume, according to the species.

Variables used in calculation: Girard Form Class, Board-foot Volume Correction Factor, Board-foot Volume Equations to Use, Species, Length, Log Product, DBH, Minimum Top Diameter for Board-foot Calculations

Other variables using log - gross board-foot volume: Gross Board-foot Volume, Net Board-foot Volume

Log Variable - Gross Cord Volume

Description: Gross cord volume.

Valid values: Gross cord volume must be greater than or equal to zero.
Units: Cords.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Gross cubic volume}}{\text{Cubic volume per cord}}$$

Variables used in calculation: Cubic Volume Per Cord, Gross Cubic Volume, Species

Other variables using log - gross cord volume: Gross Sawtimber Cord Volume, Net Tons, Gross Tons, Gross Pulpwood Cord Volume, Gross Cord Volume

Log Variable - Gross Cubic Volume

Description: Gross cubic volume.

Valid values: Gross cubic volume must be greater than or equal to zero.
Units: Cubic feet or cubic meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes (see Marquis 1977).

IF 'Log product' = "cull"
    volume = 0.0
ELSE

$$\left(\begin{array}{l} -1.70774 + (0.051321 \times \text{dbh}) + \left(0.58857 \times \left(\frac{\text{Length}}{8.0}\right)\right) + (0.0193547 \times \text{dbh}^2) \\ + \left(0.0237324 \times \text{dbh}^2 \times \left(\frac{\text{Length}}{8.0}\right)\right) - \left(0.04821 \times \left(\frac{\text{Length}}{8.0}\right)^2\right) \\ - \left(0.0002174 \times \text{dbh}^2 \times \left(\frac{\text{Length}}{8.0}\right)^2\right) - \left(0.0000239 \times \text{dbh}^2 \times \left(\frac{\text{Length}}{8.0}\right)^3\right) \\ + \left(0.00000795 \times \text{dbh}^3 \times \left(\frac{\text{Length}}{8.0}\right)^2\right) - \left(0.00000057 \times \text{dbh}^3 \times \left(\frac{\text{Length}}{8.0}\right)^3\right) \\ - \left(0.000000035 \times \text{dbh}^4 \times \left(\frac{\text{Length}}{8.0}\right)^2\right) \end{array}\right) \times \text{Cubic-foot correction factor}$$

The cubic-foot calculation was originally designed to calculate the volume for the entire tree. The essential parameters passed were the dbh and the merchantable height of the tree. In order to use this formula to calculate the volume of an individual log, we calculate the total tree volume to the top of the log and subtract the tree volume below the log.

Variables used in calculation: Cubic-foot Correction Factor, Length, Log Product, DBH

Other variables using log - gross cubic volume: Gross Pulpwood Cubic Volume, Net Cubic Volume, Gross Sawtimber Cubic Volume, Gross Cord Volume

Log Variable - Gross Tons

Description: Gross tons.

Valid values: Gross tons must be greater than or equal to zero.
Units: Tons or tonnes.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\text{Gross cord volume} \times \text{Tons per cord}$$

Variables used in calculation: Species, Tons Per Cord, Gross Cord Volume

Other variables using log - gross tons: Gross Tons Sawtimber, Gross Tons Pulpwood, Gross Tons

Log Variable - Net Board-foot Volume

Description: Net board-foot volume.

Valid values: Net board-foot Volume must be greater than or equal to zero.
Units: Board feet.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\text{Gross board-foot volume} \times \left(1.0 - \frac{\text{Sawlog defect}}{100.0}\right)$$

Variables used in calculation: Sawtimber Defect, Gross Board-foot Volume

Other variables using log - net board-foot volume: Net Board-foot Volume, Dollar Value

Log Variable - Net Cord Volume

Description: Net cord volume.

Valid values: Net cord volume must be greater than or equal to zero.

Units: Cords.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\text{Net cubic volume}}{\text{Cubic volume per cord}}$$

Variables used in calculation: Species, Net Cubic Volume, Cubic Volume Per Cord

Other variables using log - net cord volume: Net Sawtimber Cord Volume, Net Pulpwood Cord Volume, Net Cord Volume

Log Variable - Net Cubic Volume

Description: Net cubic volume. After defect has been accounted for, the remaining volume is multiplied by 0.80 to result in a standard utilization loss of 20%.

Valid values: Net cubic volume must be greater than or equal to zero.
Units: Cubic feet or cubic meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'Log product' is a sawlog product

$$\text{Gross cubic volume} \times \left(1.0 - \frac{\text{'Sawlog defect'}}{100.0}\right) \times 0.80$$

ELSE

$$\text{Gross cubic volume} \times \left(1.0 - \frac{\text{'Pulpwood defect'}}{100.0}\right) \times 0.80$$

Variables used in calculation: Sawtimber Defect, Pulpwood Defect, Gross Cubic Volume

Other variables using log - net cubic volume: Net Pulpwood Volume, Dollar Value, Net Sawtimber cubic volume, Net Cord Volume

Log Variable - Net Tons

Description: Net tons.

Valid values: Net tons must be greater than or equal to zero.
Units: Tons or tonnes.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Net cord volume × Tons per cord

Variables used in calculation: Species, Gross Cord Volume, Tons Per Cord

Other variables using log - net tons: Net Tons Sawtimber, Net Tons Pulpwood, Net Tons

Understory Variables

Tallied Understory Plot Variables

Understory Plot Variable - Average Shrub Layer Height

Description: Average height of plants between 3 and 10 feet.

Valid values: Average shrub layer height must be between 3 and 10 ft.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter an ocular estimate of the average height of plants in the shrub layer (3−10 feet high).
NED default value: None.
User-set default: Yes.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{understory}\\ \text{observations}}} \text{Height of plant}}{\text{Observation count}}$$

Only use observations where $3.0 \leq$ 'Height of plant' < 10.0

Variables used in calculation: Height of Plant

Other variables using understory plot - average shrub layer height: Average Shrub Layer Height

Understory Plot Variable - Coniferous Shrub Layer

Description: Plot contains Coniferous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the understory plot contains coniferous species in the shrub layer (3−10 feet high). The variable will default to absent but will be calculated by NED-2 if any coniferous species are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

This value is only computed if at least one observation is found where 'Height layer' is "shrub", otherwise the value's source is set to Empty.

TRUE if any observation is found where:
'Height layer' is "shrub"
AND 'Category' is "Gymnosperm" for the observation species

Variables used in calculation: Category, Height Layer, Species, Family Symbol, Family Code

Other variables using understory plot - coniferous shrub layer: Coniferous Shrub Layer

Understory Plot Variable - Cover of Foliage in Shrub Layer

Description: Percent cover of foliage between 3 and 10 feet.

Valid values: Cover of foliage in shrub layer must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. An ocular estimate of the percent cover of all herbaceous and woody plants in the shrub layer (3−10 feet high); using 10% increments is adequate.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

$$\sum_{\substack{\text{understory}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where the 'Height layer' is "shrub"
If the sum is greater than 100.0:
Percent shrub cover = 100.0

Variables used in calculation: Percent Cover, Height Layer

Other variables using understory plot - cover of foliage in shrub layer: Shrub Layer Percent Cover

Understory Plot Variable - Deciduous Shrub Layer

Description: Plot contains Deciduous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the understory plot contains deciduous species in the shrub layer (3−10 feet high). The variable will default to absent but will be calculated by NED-2 if any deciduous species are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

This value is only computed if at least one observation is found where 'Height layer' is "shrub", otherwise the value's source is set to Empty.

TRUE if any observation is found where:
'Height layer' is "shrub"
AND 'Evergreen' is FALSE for the observation species

Variables used in calculation: Evergreen, Height Layer, Species

Other variables using understory plot - deciduous shrub layer: Deciduous Shrub Layer

Understory Plot Variable - Ericaceous Shrub Layer

Description: Plot contains Ericaceous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the understory plot contains ericaceous species in the shrub layer (3−10 feet high). The variable will default to absent but will be calculated by NED-2 if any ericaceous species are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

This value is only computed if at least one observation is found where 'Height layer' is "shrub", otherwise the value's source is set to Empty.

TRUE if any observation is found where:
'Height layer' is "shrub"
AND 'Ericaceous' is TRUE for the observation species

Variables used in calculation: Ericaceous, Height Layer, Species

Other variables using understory plot - ericaceous shrub layer: Ericaceous Shrub Layer

Understory Plot Variable - Flowery Shrub Layer

Description: Plot contains shrub plants that produce showy flowers.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if any plant in the shrub layer (3−10 feet high) produces showy flowers. The variable will default to absent but will be calculated by NED-2 if species known to have showy flowers are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Height layer' is "shrub"
AND
'Showy flowers' is TRUE for the observation species

Variables used in calculation: Height Layer, Species, Showy Flowers

Other variables using understory plot - flowery shrub layer: Shrub Layer with Showy Flowers

Understory Plot Variable - Hard Mast

Description: Plot contains species that produce hard mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.

Tallied by user: Yes. Enter “present” if any ground or shrub observation produces hard mast. The variable will default to absent but will be calculated by NED-2 if species known to produce hard mast are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Mast type' is "hard" or "hard and soft" for the observation species
AND 'Living' = TRUE

Variables used in calculation: Mast Type, Species, Living

Other variables using understory plot - hard mast: Hard Mast Present

Understory Plot Variable - Map X-coordinate

Description: Map x coordinate units depend on map type.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the understory plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Understory Plot Variable - Map Y-coordinate

Description: Map y coordinate units depend on map type.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the understory plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Understory Plot Variable - Percent Regen Sprout

Description: Percent of regeneration of sprout origin.

Valid values: Percent regen sprout must be between 0 and 100.
Units: Percent stems.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of seedlings and saplings that are of sprout origin (root sprouts, sucker sprouts, etc.).
NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Other variables using understory plot - percent regen sprout: Understory Percent Regeneration Sprout

Understory Plot Variable - Potential Residual Tree

Description: Plot stocked with residual tree.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "yes" if the plot contains at least one acceptable tree between 5−10 inches dbh that will meet your management goal and survive to occupy the site after a final harvest. Acceptable commercial trees have at least moderately good crowns and clear straight boles free of branches, epicormic branches, or other defects for at least the first 17 feet. Commercial species with more than one or two epicormic branches on the butt log should not be considered acceptable residual trees.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Understory Plot Variable - Riparian Plot

Description: Riparian plot.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "yes" if any portion of the plot falls within a riparian area.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using understory plot - riparian plot: Wetland, Riparian, Contains a Riparian

Understory Plot Variable - Soft Mast

Description: Plot contains species that produce soft mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if any ground or shrub observation produces soft mast. The variable will default to absent but will be calculated by NED-2 if species known to produce soft mast are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Mast type' is "soft" or "hard and soft" for the observation species
AND 'Living' = TRUE

Variables used in calculation: Mast Type, Species, Living

Other variables using understory plot - soft mast: Soft Mast

Understory Plot Variable - Stocked with Commercial Regeneration

Description: Plot is stocked with commercial regeneration.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if the plot is stocked with commercial tree seedlings (any commercial species, but not necessarily high value species).
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using understory plot - stocked with commercial regen.: Stocked with Commercial Regen.

Understory Plot Variable - Stocked with High Value Regeneration

Description: Plot is stocked with high value regeneration.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if the plot is stocked with desirable seedlings of high-value species.
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using understory plot - stocked with high value regen.: Stocked with High Value Regen.

Understory Plot Variable - Plot ID

Description: Understory plot identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the identification name or number of the understory plot.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

```
IF there is only one plot in the cluster
        ID = the ID of the cluster
ELSE
        ID = the concatenation of the Cluster ID with a
        colon with the value of UNDER_PLOT + 1
```

Variables used in calculation: Cluster ID

Other variables using understory plot - plot id: Observation ID

Understory Plot Variable - User Comments

Description: User comments/notes.

Units: text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter any additional comments about the understory plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Understory Plot Variable - Wetland Vegetation

Description: Plot has species characteristic of wetlands.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the shrub layer (3−10 feet high) contains any wetland species. The variable will be automatically calculated if you enter wetland plants in the understory plot. If this variable is left empty, and there is no detailed plant species list, the variable will default to absent.

NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Wetland species' is TRUE for the observation species

Variables used in calculation: Wetland Species, Species

Other variables using understory plot - wetland vegetation: Wetland, Contains a Wetland

Understory Plot Variables

Understory Plot Variable - Aboveground Biomass

Description: Aboveground dry-weight biomass.

Valid values: Aboveground biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{understory}\\ \text{observations}}} \text{Aboveground biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Stems Per Unit Area, Aboveground Biomass, Living

Other variables using understory plot - aboveground biomass: Aboveground Biomass

Understory Plot Variable - Branch Biomass

Description: Branch dry-weight biomass.

Valid values: Branch biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Branch biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Branch Biomass

Other variables using understory plot - branch biomass: Branch Biomass

Understory Plot Variable - Coarse Root Biomass

Description: Coarse root dry-weight biomass.

Valid values: Coarse root biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{understory}\\ \text{observations}}} \text{Coarse root biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Coarse Root Biomass, Stems Per Unit Area

Other variables using understory plot - coarse root biomass: Coarse Root Biomass

Understory Plot Variable - Cover of Fall Color in Shrub Layer

Description: Percent cover of fall color plants between 3 and 10 feet.

Valid values: Cover of fall color in shrub layer must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{understory}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where 'Height layer' is "shrub"
AND 'Fall color' is TRUE for the observation species
If the sum is greater than 100.0, the Percent shrub fall color plants is set to 100.0

Variables used in calculation: Species, Percent Cover, Height Layer, Fall Color

Other variables using understory plot - cover of fall color in shrub layer: Shrub Layer with Fall Color

Understory Plot Variable - Cover of Fruiting Plants in Shrub Layer

Description: Percent cover of fruiting plants between 3 and 10 feet.

Valid values: Cover of fruiting plants in shrub layer must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{understory}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where 'Height layer' is "shrub"
AND 'Showy or edible fruit' is TRUE for the observation species
If the sum is greater than 100.0, the Percent shrub fruiting is set to 100.0

Variables used in calculation: Showy or Edible Fruit, Height Layer, Percent Cover, Species

Other variables using understory plot - cover of fruiting plants in shrub layer: Shrub Layer with Fruits and Nuts

Understory Plot Variable - Foliage Biomass

Description: Foliage dry-weight biomass.

Valid values: Foliage biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{understory}\\ \text{observations}}} \text{Foliage biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Foliage Biomass

Other variables using understory plot - foliage biomass: Foliage Biomass

Understory Plot Variable - Inventory Plot Count

Description: Number of plots in original inventory.

Valid values: Inventory plot count must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF this is the inventory snapshot
    Original inventory plot count = 1
ELSE
    Plot clusters containing simulated data always have one overstory plot, one understory plot, one ground plot and one transect. The value indicates how many inventory plots were combined to make the single pseudo-plot.

Understory Plot Variable - Stem Bark Biomass

Description: Stem bark dry-weight biomass.

Valid values: Stem bark biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Stem bark biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
    do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Stem Bark Biomass

Other variables using understory plot - stem bark biomass: Stem Bark Biomass

Understory Plot Variable - Stem Wood Biomass

Description: Stem wood dry-weight biomass.

Valid values: Stem wood biomass must be greater than or equal to zero.
Units: Tons per acre or megagrams per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\sum_{\substack{\text{tree}\\ \text{observations}}} \text{Stem wood biomass} \times \text{Stems per unit area}}{2000.0 \text{ lbs/ton}}$$

IF 'Include dead trees in timber values' = FALSE
do not include observations where 'Living' is FALSE

Variables used in calculation: Include Dead Trees in Timber Values, Living, Stems Per Unit Area, Stem Wood Biomass

Other variables using understory plot - stem wood biomass: Stem Wood Biomass

Tallied Understory Observation Variables

Understory Observation Variable - Custom Variable 1

Description: Custom variable 1.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to first pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Understory Observation Variable - Custom Variable 2

Description: Custom variable 2.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to second pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Understory Observation Variable - Custom Variable 3

Description: Custom variable 3.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to third pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Understory Observation Variable - Custom Variable 4

Description: Custom variable 4.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to fourth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Understory Observation Variable - Custom Variable 5

Description: Custom variable 5.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to fifth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Understory Observation Variable - Custom Variable 6

Description: Custom variable 6.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to sixth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Understory Observation Variable - DBH

Description: Diameter at breast height.

Valid values: Enter the diameter at breast height for the understory observation. Diameter can be entered in 1- or 2-inch classes or actual measurement down to a 1/10 inch. Do not mix diameter classes.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the diameter at breast height for the understory observation. Diameter can be entered in 1- or 2-inch classes or actual measurement down to a 1/10 inch. Do not mix diameter classes
NED default value: 0.1.
User-set default: Yes.
Calculated: No.

Other variables using understory observation - dbh: Stems Per Unit Area in Saplings, Stems Per Unit Area, Stems Per Unit Area in Seedlings, Q Factor, Stand Merchantable Medial DBH, Stand Quadratic Mean DBH, Stand Medial DBH, Understory Observation Relative Density, Understory Observation Basal Area, Stand Basal Area, Foliage Biomass, Coarse Root Biomass, Basal Area in Saplings, Stand Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stand Merchantable Quadratic Mean DBH, Stand Average DBH, Cluster Average DBH, Aboveground Biomass, Cluster Merchantable Quadratic Mean DBH, Cluster Medial DBH, Cluster Merchantable Medial DBH, Cluster Quadratic Mean DBH

Understory Observation Variable - Height Class

Description: Height class of observation.

Valid values: Height class must be greater than or equal to zero.
Units: Code.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the user-defined height class code that best represents the approximate height of the understory observation.
NED default value: 0.
User-set default: Yes.
Calculated: Yes.

The value of 'Size class ranges' is parsed into the user-defined ranges of height classes. The value of 'Height of plant' is compared to each range to determine the height class.

Variables used in calculation: Height of Plant, Height Class Ranges

Other variables using understory observation - height class: Height Layer

Understory Observation Variable - Living

Description: Plant is alive.

Units: Living/dead.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "yes" or "living" if the plant is alive.
NED default value: TRUE.
User-set default: Yes.
Calculated: No.

Other variables using understory observation - living: Basal Area, Relative Density, Coarse Root Biomass, Foliage Biomass, Hard Mast, Basal Area in Saplings, Total Biomass, Soft Mast, Branch Biomass, Stem Wood Biomass, Stem Bark Biomass, Aboveground Biomass

Understory Observation Variable - Origin of Plant

Description: Origin of plant.

Valid values: Origin of plant must be 1="seedling", 2="stump sprout", 3="root sprout", 4="seedling sprout", or 5="other".
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter the code (1-5) that reflects the establishment origin of the understory observation.
NED default value: Seedling.
User-set default: Yes.
Calculated: No.

Understory Observation Variable - Percent Cover

Description: Percent cover of this species.

Valid values: Percent cover must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the fixed area plot that is covered by the species. This is used for both herbaceous and woody species. If you enter woody stems and include only dbh, NED-2 will not estimate percent cover. Depending on the analysis you need, you may want to record the percent cover of each woody understory observation in addition to dbh.
NED default value: None.
User-set default: Yes.

Calculated: No.

Other variables using understory observation - percent cover: Cover of Foliage in Shrub Layer, Cover of Fall Color in Shrub Layer, Cover of Fruiting Plants in Shrub Layer

Understory Observation Variable - Species

Description: Plant species.

Units: Symbol.
Variable type: Species.

Editable by user: Yes.
Tallied by user: Yes. For every tallied observation, enter the species using either USDA PLANTS Database symbol (such as ACSA3 for sugar maple), the 3-digit FIA code (such as 318 for sugar maple), or a user-defined code (such as SM for sugar maple).
NED default value: NED999.
User-set default: No.
Calculated: No.

Other variables using understory observation - species: Rare Plants Present, Exotic Plants Present, Percent Basal Area Evergreen, Percent Basal Area Conifer, Percent Basal Area Hardwoods, Percent Basal Area High Value, Percent Basal Area Commercial, Cover of Fall Color in Shrub Layer, Coniferous Shrub Layer, Deciduous Shrub Layer, Ericaceous Shrub Layer, Wetland Vegetation, Soft Mast, Hard Mast, Flowery Shrub Layer, Relative Density, Cover of Fruiting Plants in Shrub Layer, Foliage Biomass, Stem Bark Biomass, Stem Wood Biomass, Effective Age, Total Biomass, Coarse Root Biomass, Basal Area, DBH, Aboveground Biomass

Understory Observation Variable - Stem Count

Description: Stem count.

Valid values: Stem count must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the number of stems of the species. This is used for both woody and herbaceous species.
NED default value: 1.
User-set default: Yes.
Calculated: No.

Other variables using understory observation - stem count: Stems Per Unit Area

Understory Observation Variable - Height of Plant

Description: Height of plant.

Valid values: Height of plant must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the height of the plant from the ground to the tip of the leader or top of the crown.
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using understory observation - height of plant: Height Class, Average Shrub Layer Height, Height Layer

Understory Observation Variable - Observation ID

Description: Understory observation identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the identification name or number of the understory observation.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

Concatenation of the Plot ID with a colon
with the value of UNDER_OBS + 1

Variables used in calculation: Plot ID

Understory Observation Variables

Understory Observation Variable - Aboveground Biomass

Description: Aboveground dry-weight biomass.

Valid values: Aboveground biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4
biomass = 0.0
ELSE
biomass = $\frac{\text{Exp}(\beta_1 + (\beta_2 \times \ln(\text{dbh} \times 2.54)))}{0.4535924}$
where:

NOTE: the original equations are in metric, where dbh is centimeters and the resulting biomass is in kilograms.
Only calculated where the species 'Growth form' is "Tree" or "Shrub"

β_1 = -2.2094 and β_2 = 2.3867 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -1.9123 and β_2 = 2.3651 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -2.4800 and β_2 = 2.4835 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

β_1 = -2.0127 and β_2 = 2.4342 if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

β_1 = -2.0366 and β_2 = 2.2592 if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

β_1 = -2.2304 and β_2 = 2.4435 if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

β_1 = -2.5384 and β_2 = 2.4814 if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

β_1 = -2.5356 and β_2 = 2.4349 if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

β_1 = -2.0773 and β_2 = 2.3323 if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

β_1 = -0.7152 and β_2 = 1.7029 if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: Growth Form, Species, DBH

Other variables using understory observation - aboveground biomass: Total Biomass, Coarse Root Biomass, Branch Biomass, Stem Bark Biomass, Stem Wood Biomass, Aboveground Biomass, Foliage Biomass

Understory Observation Variable - Basal Area

Description: Basal area.

Valid values: Basal area must be greater than or equal to zero.
Units: Square feet or square meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF dbh < 1.0

Basal area = 0.0

ELSE

$$\text{Basal area} = \text{dbh}^2 \times \left(\frac{\pi}{(144 * 4)} \right)$$

Only calculated where the species 'Growth form' is "Tree" or "Shrub"

Variables used in calculation: DBH, Species, Growth Form

Other variables using understory observation - basal area: Percent Basal Area Hardwoods, Percent Basal Area Evergreen, Percent Basal Area Conifer, Percent Basal Area High Value, Percent Basal Area Commercial, Basal Area, Basal Area in Saplings

Understory Observation Variable - Branch Biomass

Description: Branch dry-weight biomass.

Valid values: Branch biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

Aboveground biomass - (Foliage biomass + Stem bark biomass + Stem wood biomass)

Variables used in calculation: Stem Wood Biomass, Aboveground Biomass, Stem Bark Biomass, Foliage Biomass

Other variables using understory observation - branch biomass: Branch Biomass

Understory Observation Variable - Coarse Root Biomass

Description: Coarse root dry-weight biomass.

Valid values: Coarse root biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4
biomass = 0.0
ELSE
biomass = 'Aboveground biomass' × $\mathrm{Exp}\left(\beta_1 + \left(\frac{\beta_2}{\mathrm{dbh} \times 2.54}\right)\right)$
where:

NOTE: the original equations are in metric, where dbh is centimeters
Only calculated where the species 'Growth form' is "Tree" or "Shrub"

β_1 = -1.6911 and β_2 = 0.8160 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -1.6911 and β_2 = 0.8160 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -1.6911 and β_2 = 0.8160 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

$\beta_1 = -1.6911$ and $\beta_2 = 0.8160$ if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

$\beta_1 = -1.5619$ and $\beta_2 = 0.6614$ if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: DBH, Aboveground Biomass, Growth Form, Species

Other variables using understory observation - coarse root biomass: Coarse Root Biomass, Total Biomass

Understory Observation Variable - Crown Ratio

Description: Crown ratio of the tree - simulated data only.

Valid values: Crown ratio must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Understory Observation Variable - Foliage Biomass

Description: Foliage dry-weight biomass.

Valid values: Foliage biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4

biomass = 0.0

ELSE

biomass = 'Aboveground biomass' × $\mathrm{Exp}\left(\beta_1 + \left(\frac{\beta_2}{\mathrm{dbh} \times 2.54}\right)\right)$

where:

NOTE: the original equations are in metric, where dbh is centimeters

Only calculated where the species 'Growth form' is "Tree" or "Shrub"

β_1 = -4.0813 and β_2 = 5.8816 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -4.0813 and β_2 = 5.8816 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -4.0813 and β_2 = 5.8816 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

β_1 = -4.0813 and β_2 = 5.8816 if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

β_1 = -2.9584 and β_2 = 4.4766 if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

β_1 = -2.9584 and β_2 = 4.4766 if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

β_1 = -2.9584 and β_2 = 4.4766 if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

β_1 = -2.9584 and β_2 = 4.4766 if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

β_1 = -2.9584 and β_2 = 4.4766 if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

β_1 = -2.9584 and β_2 = 4.4766 if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: DBH, Species, Growth Form, Aboveground Biomass

Other variables using understory observation - foliage biomass: Foliage Biomass, Branch Biomass

Understory Observation Variable - Height Layer

Description: NED height layer.

Valid values: Height layer must be 1="ground" or 2="shrub".
Units: Code.
Variable type: Category.

Editable by user: No.
Tallied by user: No.
NED default value: Shrub.
User-set default: No.
Calculated: Yes.

If there is a value for 'Height of plant' then the 'Height layer' is determined as follows:

IF (0.0 <= Height of plant < 3.0)
    Height layer = "ground"
ELSE IF (3.0 <= Height of plant < 10.0)
    Height layer = "shrub"

Otherwise, if there is a value for 'Height class' then the 'Height layer' is determined by parsing the value of 'Size class ranges' into the user-defined ranges of height classes. The range corresponding to the 'Height class' is found. The 'Height layer' is then determined as follows:

IF (0.0 <= range midpoint < 3.0)
    Height layer = "ground"
ELSE IF (3.0 <= range midpoint < 10.0)
    Height layer = "shrub"
WHERE:

$$\text{range midpoint} = \left(\frac{\text{range maximum - range minimum}}{2.0} \right)$$

Variables used in calculation: Height Class, Height of Plant, Height Class Ranges

Other variables using understory observation - height layer: Coniferous Shrub Layer, Deciduous Shrub Layer, Ericaceous Shrub Layer, Cover of Foliage in Shrub Layer, Cover of Fall Color in Shrub Layer, Flowery Shrub Layer, Cover of Fruiting Plants in Shrub Layer

Understory Observation Variable - Maximum Crown Width

Description: Maximum width of the crown - simulated data only.

Valid values: Maximum crown width must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: No.

Understory Observation Variable - Relative Density

Description: Relative density contribution of individual trees using the tree-area ratio concept as described in Stout et al. (1987). Coefficients for individual species or species groups, listed below, were developed from their respective stocking guides identified in the references.

Valid values: Relative density must be greater than or equal to zero.
Units: Percent.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF dbh < 1.0
    Relative density = 0.0
ELSE

$$\text{Relative density} = \left(k_1 + \left(k_2 \times \text{dbh}\right) + \left(k_3 \times \text{dbh}^2\right)\right)$$

where k_1, k_2 and k_3 depend on the species:

k_1= 0.0077041, k_2= 0.00626130, k_3= 0.00384800 if FIA code is 531,371,318 (Beech, Y Birch, S Maple)
k_1=-0.0197010, k_2= 0.02164000, k_3= 0.00031039 if FIA code is 12,90-98 (Balsam Fir, Spruce)
k_1= 0.0279800, k_2= 0.00783220, k_3= 0.00174670 if FIA code is 129 (White Pine)
k_1=-0.0254180, k_2= 0.01475300, k_3= 0.00162290 if FIA code is 125 (Red Pine)
k_1=-0.0115280, k_2= 0.00085458, k_3= 0.00264390 if FIA code is 261 (Hemlock)
k_1= 0.0442830, k_2= 0.01294600, k_3= 0.00587480 if FIA code is 375 (P. Birch)
k_1= 0.0279370, k_2= 0.01545200, k_3= 0.00087100 if FIA code is 541,621,762 (W Ash, Cherry, Y Poplar)
k_1= 0.0325890, k_2= 0.00743860, k_3= 0.00383380 if FIA code is 544,742,972 (G. Ash, Cottonwood, A Elm)
k_1= 0.0308780, k_2= 0.01805800, k_3= 0.00423210 if FIA code is 602 (Black Walnut)
k_1=-0.0024055, k_2= 0.00494220, k_3= 0.00226670 if FIA code is 241 (W. Cedar)
k_1=-0.0053402, k_2= 0.00737650, k_3= 0.00432100 if FIA code is 833 (Red Oak)
k_1= 0.0028020, k_2= 0.01188100, k_3= 0.00354600 if FIA code is 400-409,800-850 (Hickories, other Oaks)
k_1=-0.0081504, k_2= 0.00081670, k_3= 0.00280480 if FIA code is 951 (A Basswood)
k_1= 0.0041871, k_2= 0.01255100, k_3= 0.00237960 if FIA code is 746,743 (Q Aspen, B Aspen)
k_1=-0.0721970, k_2= 0.03416300, k_3= 0.00102220 for any softwoods not listed elsewhere (FIA < 300)
k_1=-0.0179790, k_2= 0.02142500, k_3= 0.00171100 for any hardwoods not listed elsewhere (FIA ≥ 300)

If the above calculation is less than zero, the relative density will be set to zero

The original formula was based on an A-line of 80% for White Pine, so if the FIA code is129 (White Pine) the calculated value is multiplied by 0.8 (Philbrook et al. 1973).

Variables used in calculation: DBH, Species, Growth Form

Other variables using understory observation - relative density: Relative Density

Understory Observation Variable - Stem Bark Biomass

Description: Stem bark dry-weight biomass.

Valid values: Stem bark biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4
biomass = 0.0
ELSE
biomass = 'Aboveground biomass' × $\mathrm{Exp}\left(\beta_1 + \left(\frac{\beta_2}{\mathrm{dbh} \times 2.54}\right)\right)$
where:

NOTE: the original equations are in metric, where dbh is centimeters
Only calculated where the species 'Growth form' is "Tree" or "Shrub"

β_1 = -2.0129 and β_2 = -1.6805 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -2.0129 and β_2 = -1.6805 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -2.0129 and β_2 = -1.6805 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

β_1 = -2.0129 and β_2 = -1.6805 if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

β_1 = -2.0980 and β_2 = -1.1432 if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: Species, DBH, Aboveground Biomass, Growth Form

Other variables using understory observation - stem bark biomass: Branch Biomass, Stem Bark Biomass

Understory Observation Variable - Stem Wood Biomass

Description: Stem wood dry-weight biomass.

Valid values: Stem wood biomass must be greater than or equal to zero.
Units: Pounds or kilograms.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF 'dbh' < 0.4
biomass = 0.0
ELSE
biomass = 'Aboveground biomass' × $\mathrm{Exp}\left(\beta_1 + \left(\frac{\beta_2}{\mathrm{dbh} \times 2.54}\right)\right)$
where:

NOTE: the original equations are in metric, where dbh is centimeters
Only calculated where the species 'Growth form' is "Tree" or "Shrub"

β_1 = -0.3065 and β_2 = -5.4240 if the 'Species' is one of the following:

ALRH2 (white alder)	PODE3 (eastern cottonwood)	POTR5 (quaking aspen)
ALRU2 (red alder)	POFR2 (Fremont cottonwood)	POBAT (black cottonwood)
ALINR (speckled alder)	POGR4 (bigtooth aspen)	SAAM2 (peachleaf willow)
POAL7 (white poplar)	POHE4 (swamp cottonwood)	SAER (Missouri River willow)
POAN3 (narrowleaf cottonwood)	PODEM (plains cottonwood)	SANI (black willow)
POBA2 (balsam poplar)	POPUL (cottonwood)	SALIX (willow)

β_1 = -0.3065 and β_2 = -5.4240 if the 'Species' is one of the following:

ACNI5 (black maple)	QUDO (blue oak)	QUMA3 (blackjack oak)
ACSA3 (sugar maple)	QUSIS (bastard oak)	QUMI (swamp chestnut oak)
CAAQ2 (water hickory)	QUEL (northern pin oak)	QUMU (chinkapin oak)
CACO15 (bitternut hickory)	QUEN (Engelmann oak)	QUNI (water oak)
CAGL8 (pignut hickory)	QUFA (southern red oak)	QUTE (Texas red oak)
CAIL2 (pecan)	QUPA5 (cherrybark oak)	QUPA2 (pin oak)
CALA21 (shellbark hickory)	QUGA4 (Oregon white oak)	QUPH (willow oak)
CAOV2 (shagbark hickory)	QUIL (bear oak)	QUPR2 (chestnut oak)
CARYA (hickory)	QUIM (shingle oak)	QURU (northern red oak)
CATE9 (black hickory)	QUIN (bluejack oak)	QUSH (Shumard's oak)
CAAL27 (mockernut hickory)	QUKE (California black oak)	QUERC (oak)
FAGR (American beech)	QULA2 (turkey oak)	QUST (post oak)
QUAG (California live oak)	QULA3 (laurel oak)	QUSI2 (bottomland post oak)
QUAL (white oak)	QULO (California white oak)	QUVE (black oak)
QUBI (swamp white oak)	QULY (overcup oak)	QUVI (live oak)
QUCH2 (canyon live oak)	QUMA2 (bur oak)	QUWI2 (interior live oak)
QUCO2 (scarlet oak)		

β_1 = -0.3065 and β_2 = -5.4240 if the 'Species' is one of the following:

AECA (California buckeye)	FRPR (pumpkin ash)	OSVI (hophornbeam)
AEGL (Ohio buckeye)	FRQU (blue ash)	OXAR (sourwood)
AEFL (yellow buckeye)	FRAXI (ash)	PATO2 (princesstree)
AESCU (buckeye)	GLAQ (water locust)	PEBO (redbay)
AESCU (buckeye)	GLTR (honeylocust)	PLAQ (planertree)
AIAL (tree of heaven)	GOLA (loblolly bay)	PLOC (American sycamore)
AILAN (ailanthus)	GYDI (Kentucky coffeetree)	PLRA (California sycamore)
AMELA (serviceberry)	HALES (silverbell)	PRAM (American plum)
ARME (Pacific madrone)	NED004 (commercial hardwood)	PRNI (Canadian plum)
ASTR (pawpaw)	NED005 (high value hardwood)	PRPE2 (pin cherry)
SILAL3 (gum bully)	NED006 (non-comm hardwood)	PRSE2 (black cherry)
CACA18 (American hornbeam)	ILOP (American holly)	PRUNU (plum)
CADE12 (American chestnut)	JUCI (butternut)	PRUNU (plum)
CAPUO (Ozark chinkapin)	JUNI (black walnut)	PRVI (chokecherry)
CAPU9 (chinkapin)	JUGLA (walnut)	ROPS (black locust)
CHCHC4 (giant chinquapin)	LIST2 (sweetgum)	TRSE6 (tallowtree)
CABI8 (southern catalpa)	LITU (tuliptree)	SAAL5 (sassafras)
CASP8 (northern catalpa)	LIDE3 (tanoak)	SOAM3 (American mountain ash)
CATAL (catalpa)	MAPO (osage orange)	SOAU (European mountain ash)
CELA (sugarberry)	MAAC (cucumber-tree)	TIAM (American basswood)
CEOC (common hackberry)	MAGR4 (southern magnolia)	TIAMH (American basswood)
CELTI (hackberry)	MAMA2 (bigleaf magnolia)	TILIA (basswood)
CECA4 (eastern redbud)	MAGNO (magnolia)	ULAL (winged elm)
COFL2 (flowering dogwood)	MAVI2 (sweetbay)	ULAM (American elm)
CONU4 (Pacific dogwood)	MALUS (apple)	ULCR (cedar elm)
COOB2 (American smoketree)	MEAZ (Chinaberrytree)	ULPU (Siberian elm)
CRATA (hawthorn)	MOAL (white mulberry)	ULRU (slippery elm)
DIVI5 (common persimmon)	MORU2 (red mulberry)	ULSE (September elm)
EUCAL (gum)	MORUS (mulberry)	ULMUS (elm)
FRAM2 (white ash)	NYAQ2 (water tupelo)	ULTH (rock elm)
FRLA (Oregon ash)	NYOG (Ogeechee tupelo)	UMCA (California laurel)
FRNI (black ash)	NYSY (blackgum)	VAAR (farkleberry)
FRPE (green ash)	NYBI (swamp tupelo)	

β_1 = -0.3065 and β_2 = -5.4240 if the 'Species' is one of the following:

ACBA3 (southern sugar maple)	ACSA2 (silver maple)	BEOC2 (wat
ACMA3 (bigleaf maple)	ACSP2 (mountain maple)	BEPA (paper birch)
ACNE2 (boxelder)	BEAL2 (yellow birch)	BEPAC (western paper birch)
ACPE (striped maple)	BELE (sweet birch)	BEPO (gray birch)
ACRU (red maple)	BENI (river birch)	BETUL (birch)

β_1 = -0.3737 and β_2 = -1.8055 if the 'Species' is one of the following:

CADE27 (incense cedar)	LALY (subalpine larch)	NED002 (high value softwood)
CHLA (Port Orford cedar)	LAOC (western larch)	NED003 (non-comm softwood)
CHNO (Alaska cedar)	LARIX (larch)	TADI2 (bald cypress)
CHTH2 (Atlantic white cedar)	SESE3 (redwood)	TAAS (pond cypress)
JUVIS (southern redcedar)	SEGI2 (giant sequoia)	THOC2 (arborvitae)
JUVI (eastern redcedar)	NED001 (commercial softwood)	THPL (western red cedar)
LALA (tamarack)		

β_1 = -0.3737 and β_2 = -1.8055 if the 'Species' is one of the following:

PSMA (bigcone Douglas-fir)
PSME (Douglas-fir)

β_1 = -0.3737 and β_2 = -1.8055 if the 'Species' is one of the following:

PIAL (whitebark pine)	PIEL (slash pine)	PIPO (ponderosa pine)
PIAR (bristlecone pine)	PIEN2 (Apache pine)	PIPU5 (Table Mountain pine)
PIAR5 (Arizona pine)	PIFL2 (limber pine)	PIRA2 (Monterey pine)
PIAT (knobcone pine)	PIGL2 (spruce pine)	PIRE (red pine)
PIBA (foxtail pine)	PIJE (Jeffrey pine)	PIRI (pitch pine)
PIBA2 (jack pine)	PILA (sugar pine)	PISA2 (California foothill pine)
PICL (sand pine)	PILE (Chihuahuan pine)	PISE (pond pine)
PICO (lodgepole pine)	PIMO (singleleaf pinyon)	PIST3 (southwestern white pine)
PICO3 (Coulter pine)	PIMO3 (western white pine)	PIST (eastern white pine)
PIDI3 (border pinyon)	PIMU (Bishop pine)	PISY (Scotch pine)
PIEC2 (shortleaf pine)	PINI (Austrian pine)	PITA (loblolly pine)
PIED (twoneedle pinyon)	PIPA2 (longleaf pine)	PIVI2 (Virginia pine)

β_1 = -0.3737 and β_2 = -1.8055 if the 'Species' is one of the following:

PIAB (Norway spruce)	PIGL (white spruce)	PIRU (red spruce)
PIBR (Brewer spruce)	PIMA (black spruce)	PISI (Sitka spruce)
PIEN (Engelmann spruce)	PIPU (blue spruce)	PICEA (spruce)

β_1 = -0.3737 and β_2 = -1.8055 if the 'Species' is one of the following:

ABAM (Pacific silver fir)	ABLAA (corkbark fir)	TOCA (California nutmeg)
ABBA (balsam fir)	ABMA (California red fir)	TSCA (eastern hemlock)
ABBR (bristlecone fir)	ABSH (Shasta red fir)	TSCA2 (Carolina hemlock)
ABCO (white fir)	ABPR (noble fir)	TSHE (western hemlock)
ABFR (Fraser fir)	ABIES (fir)	TSME (mountain hemlock)
ABGR (grand fir)	TABR2 (Pacific yew)	TSUGA (hemlock)
ABLA (subalpine fir)		

β_1 = -0.3737 and β_2 = -1.8055 if the 'Species' is one of the following:

ACACI (acacia)	JUCA7 (California juniper)	OLTE (desert ironwood)
ACGL (Rocky Mountain maple)	JUCO6 (common juniper)	QUAR (Arizona white oak)
ACGR3 (bigtooth maple)	JUDE2 (alligator juniper)	QUEM (Emory oak)
CEIN7 (littleleaf mountain mahogany)	JUCO11 (redberry juniper)	QUGA (Gambel oak)
CELE3 (curl-leaf mountain mahogany)	JUMO (oneseed juniper)	QUHY (silverleaf oak)
CEMO2 (alderleaf mountain mahogany)	JUOC (western juniper)	QUOB (Mexican blue oak)
CEMOG (birchleaf mountain mahogany)	JUOS (Utah juniper)	QUERC (oak)
CEMOP (hairy mountain mahogany)	JUPI (Pinchot's juniper)	QUERC (oak)
CUAR (Arizona cypress)	JUSC2 (Rocky Mountain juniper)	RONE (New Mexico locust)
CUPRE (cypress)		

After Jenkins et al. 2003.

Variables used in calculation: Species, DBH, Aboveground Biomass, Growth Form

Other variables using understory observation - stem wood biomass: Branch Biomass, Stem Wood Biomass

Understory Observation Variable - Stems Per Unit Area

Description: Number of stems per unit area represented by this observation.

Valid values: Stems Per Unit Area must be between 0 and 99999.
Units: Stems per acre or stems per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\left(\frac{1.0}{\text{Understory plot size}}\right) \times \text{Stem count}$$

Note: this is only calculated for inventory snapshots

Variables used in calculation: Stem Count, Understory Plot Size

Other variables using understory observation - stems per unit area: Stems Per Unit Area in Seedlings, Stems Per Unit Area in Saplings, Stems Per Unit Area, Stand Merchantable Medial DBH, Q Factor, Stand Quadratic Mean DBH, Stand Medial DBH, Percent Basal Area Evergreen, Percent Basal Area Conifer, Percent Basal Area Hardwoods, Relative Density, Stand Merchantable Quadratic Mean DBH, Percent Basal Area High Value, Percent Basal Area Commercial, Basal Area, Total Biomass, Coarse Root Biomass, Foliage Biomass, Aboveground Biomass, Basal Area in Saplings, Branch Biomass, Stem Wood Biomass, Stem Bark Biomass, Stand average DBH, Cluster Average DBH, Cluster Medial DBH, Cluster Merchantable Quadratic DBH, Cluster Merchantable Medial DBH, Cluster Quadratic Mean DBH

Ground-cover Variables

Tallied Ground-cover Plot Variables

Ground Plot Variable - Average Shrub Layer Height

Description: Average height of plants between 3 and 10 feet.

Valid values: Average shrub layer height must be between 3 and 10 feet.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the ocular estimate of the average heights of plants in the shrub layer (3−10 feet).
NED default value: None.
User-set default: Yes.
Calculated: Yes.

$$\frac{\sum_{\text{ground observations}} \text{Height of plant}}{\text{Observation count}}$$

Only use observations where $3.0 \leq$ 'Height of plant' < 10.0

Variables used in calculation: Height of Plant

Other variables using ground plot - average shrub layer height: Average Shrub Layer Height

Ground Plot Variable - Coniferous Shrub Layer

Description: Plot contains coniferous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the ground plot contains coniferous species in the shrub layer (3−10 feet high). The variable will default to absent but will be calculated by NED-2 if any coniferous species are present in the inventory.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

This value is only computed if at least one observation is found where 'Height layer' is "shrub", otherwise the value's source is set to Empty.

TRUE if any observation is found where:
'Height layer' is "shrub"
AND 'Category' is "Gymnosperm" for the observation species

Variables used in calculation: Height Layer, Species, Category, Family Code, Family Symbol

Other variables using ground plot - coniferous shrub layer: Coniferous Shrub Layer

Ground Plot Variable - Cover of Foliage in Ground Layer

Description: Percent cover of foliage between 0−3 feet.

Valid values: Cover of foliage in ground layer must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter an ocular estimate of the percent cover of all herbaceous and woody plants in the ground layer (0−3 feet high); using 10% increments is adequate.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where the 'Height layer' is "ground"
If the sum is greater than 100.0, the Percent ground cover is set to 100.0

Variables used in calculation: Height Layer, Percent Cover

Other variables using ground plot - cover of foliage in ground layer: Percent Ground Cover

Ground Plot Variable - Cover of Foliage in Shrub Layer

Description: Percent cover of foliage between 3 and 10 feet.

Valid values: Cover of foliage in shrub layer must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter an ocular estimate of the percent cover of all herbaceous and woody plants in the shrub layer (3−10 feet); using 10% increments is adequate.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where the 'Height layer' is "shrub"
If the sum is greater than 100.0, the Percent shrub cover is set to 100.0

Variables used in calculation: Height Layer, Percent Cover

Other variables using ground plot - cover of foliage in shrub layer: Shrub Layer Percent Cover

Ground Plot Variable - Deciduous Shrub Layer

Description: Plot contains deciduous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the ground plot contains deciduous species in the shrub layer (3−10 feet high). The variable will default to absent but will be calculated by NED-2 if any deciduous species are present in the inventory.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

This value is only computed if at least one observation is found where 'Height layer' is "shrub", otherwise the value's source is set to Empty.

TRUE if any observation is found where:
'Height layer' is "shrub"
AND 'Evergreen' is FALSE for the observation species

Variables used in calculation: Species, Height Layer, Evergreen

Other variables using ground plot - deciduous shrub layer: Deciduous Shrub Layer

Ground Plot Variable - Ericaceous Shrub Layer

Description: Plot contains ericaceous species in shrub layer.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the ground plot contains ericaceous species in the shrub layer (3−10 feet high). The variable will default to absent but will be calculated by NED-2 if any ericaceous species are present in the inventory.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

This value is only computed if at least one observation is found where 'Height layer' is "shrub", otherwise the value's source is set to Empty.

TRUE if any observation is found where:
'Height layer' is "shrub"
AND 'Ericaceous' is TRUE for the observation species

Variables used in calculation: Height Layer, Species, Ericaceous

Other variables using ground plot - ericaceous shrub layer: Ericaceous Shrub Layer

Ground Plot Variable - Flowery Ground Layer

Description: Plot contains ground plants that produce showy flowers.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if any ground plant produces showy flowers that are 0−3 feet high. The variable will default to absent but will be calculated by NED-2 if species known to produce showy flowers are present in the inventory.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Height layer' is "ground"
AND
'Showy flowers' is TRUE for the observation species

Variables used in calculation: Height Layer, Species, Showy Flowers

Other variables using ground plot - flowery ground layer: Ground Layer with Showy Flowers

Ground Plot Variable - Flowery Shrub Layer

Description: Plot contains shrub plants that produce showy flowers.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if any ground plant produces showy flowers 3−10 feet high. The variable will default to absent but will be calculated by NED-2 if species known to produce showy flowers are present in the inventory.
NED default value: None.

User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Height layer' is "shrub"
AND
'Showy flowers' is TRUE for the observation species

Variables used in calculation: Height Layer, Species, Showy Flowers

Other variables using ground plot - flowery shrub layer: Shrub Layer with Showy Flowers

Ground Plot Variable - Hard Mast

Description: Plot contains species that produce hard mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "present" if the species in any ground or shrub observation produces hard mast. The variable will default to absent but will be calculated by NED-2 if species known to produce hard mast are present in the inventory.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Mast type' is "hard" or "hard and soft" for the observation species
AND 'Living' = TRUE

Variables used in calculation: Species, Mast Type

Other variables using ground plot - hard mast: Hard Mast Present

Ground Plot Variable - Litter Depth

Description: Depth of litter.

Valid values: Litter depth must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the depth of undecomposed leaf litter and organic matter on top of the mineral soil.

NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Other variables using ground plot - litter depth: Litter Depth

Ground Plot Variable - Map X-coordinate

Description: Map x coordinate units depend on map type.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the ground-cover plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Ground Plot Variable - Map Y-coordinate

Description: Map y coordinate units depend on map type.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the ground-cover plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Ground Plot Variable - Percent Grass and Sedge

Description: Percent of plot covered by grass and sedge.

Valid values: Percent grass and sedge must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the ground-cover plot that is covered by grass and sedge that will inhibit seedling establishment and growth.
NED default value: 0.0.
User-set default: Yes.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where the species 'Growth form' is "Graminoid"
If the sum is greater than 100.0, the Percent grass and sedge is set to 100.0

Variables used in calculation: Percent Cover, Species, Growth Form

Ground Plot Variable - Percent Inhibiting Fern

Description: Percent of plot covered by inhibiting fern.

Valid values: Percent inhibiting fern must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the plot that is covered by any ferns that will inhibit seedling establishment and growth, for example either hayscented or New York fern. If identity is uncertain, count any fern that grows as individual fronds from the ground level and ignore any ferns that grow in clumps.
NED default value: 0.0.
User-set default: Yes.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where the species is
"THNO" (New York fern) or "DEPU2" (eastern hayscented fern)
If the sum is greater than 100.0, the Percent inhibiting fern is set to 100.0

Variables used in calculation: Percent Cover, Species

Ground Plot Variable - Percent Litter

Description: Percent of plot covered by litter.

Valid values: Percent litter must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the ground-cover plot that is covered by forest litter (leaves, small twigs, etc.).
NED default value: 0.0.

User-set default: Yes.
Calculated: No.

Other variables using ground plot - percent litter: Percent Cover of Leaf Litter

Ground Plot Variable - Percent Moss

Description: Percent of plot covered by moss.

Valid values: Percent moss must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the ground-cover plot that is covered by moss.
NED default value: 0.0.
User-set default: Yes.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where the 'Category' for the plant species family is "Moss"
If the sum is greater than 100.0, the Percent moss is set to 100.0

Variables used in calculation: Percent Cover, Species, Category, Family Code

Ground Plot Variable - Percent Other Fern

Description: Percent of plot covered by non-inhibiting fern.

Valid values: Percent other fern must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the plot that is covered by any fern that will not inhibit seedling establishment and growth.
NED default value: 0.0.
User-set default: Yes.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where the 'Category' for the plant species family is "Fern"
AND the species is not "THNO" (New York fern) or "DEPU2" (eastern hayscented fern)
If the sum is greater than 100.0, the Percent other fern is set to 100.0

Variables used in calculation: Species, Percent Cover, Category, Family Code

Ground Plot Variable - Percent Regeneration Sprout

Description: Percent of regeneration of sprout origin.

Valid values: Percent regeneration sprout must be between 0 and 100.
Units: Percent stems.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of seedlings and saplings that are of sprout origin (root sprouts, sucker sprouts, etc.).
NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Other variables using ground plot - percent regen sprout: Ground Percent Regeneration Sprout

Ground Plot Variable - Percent Rock

Description: Percent of plot covered by rock.

Valid values: Percent rock must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the ground-cover plot that is covered by surface rocks. Surface rocks are those that can easily be turned over using your hand or with a rake.
NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Other variables using ground plot - percent rock: Percent Cover Rock

Ground Plot Variable - Plot ID

Description: Ground plot identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the ground-cover plot identification name or number.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

```
IF there is only one plot in the cluster
        ID = the ID of the cluster
ELSE
        ID = the concatenation of the Cluster ID with a
        colon with the value of GROUND_PLOT + 1
```

Variables used in calculation: Cluster ID

Other variables using ground plot - plot id: Observation ID

Ground Plot Variable - Riparian Plot

Description: Riparian plot.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if any portion of the plot falls within a riparian area.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using ground plot - riparian plot: Wetland, Riparian, Contains a Riparian

Ground Plot Variable - Rockiness Barrier to Regeneration

Description: Rockiness is a barrier to regeneration.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if rocks or stones will inhibit seedling regeneration.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Ground Plot Variable - Soft Mast

Description: Plot contains species that produce soft mast.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if any ground or shrub observation produces soft mast. The variable will default to absent but will be calculated by NED-2 if species known to produce soft mast are present in the inventory.

NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
'Mast type' is "soft" or "hard and soft" for the observation species
AND 'Living' = TRUE

Variables used in calculation: Mast Type, Species

Other variables using ground plot - soft mast: Soft Mast

Ground Plot Variable - Stocked with Commercial Regeneration

Description: Plot is stocked with commercial regeneration.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if the plot is stocked with commercial tree seedlings (any commercial species, but not necessarily high value species).
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using ground plot - stocked with commercial regen.: Stocked with Commercial Regen.

Ground Plot Variable - Stocked with High Value Regeneration

Description: Plot is stocked with high value regeneration.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if the plot is stocked with desirable seedlings of high-value species.
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using ground plot - stocked with high value regen.: Stocked with High Value Regen.

Ground Plot Variable - User Comments

Description: User comments/notes.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter any additional comments about the ground-cover plot.
NED default value: None.
User-set default: Yes.
Calculated: No.

Ground Plot Variable - Wetness Barrier to Regeneration

Description: Wetness is a barrier to regeneration.

Units: Yes/no.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if wetness or poorly drained soils will inhibit seedling regeneration. Look for areas covered by a fine layer of silt and depressions filled with blackened leaves during the dry season.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Ground Plot Variable - Wetland Vegetation

Description: Plot has species characteristic of wetlands.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if wetland ground species are present. This variable will be automatically calculated in the program if wetland plants are entered in the ground-cover plot.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if any observation is found where:
    'Wetland species' is TRUE for the observation species

Variables used in calculation: Species, Wetland Species

Other variables using ground plot - wetland vegetation: Wetland, Contains a Wetland

Ground-cover Plot Variables

Ground Plot Variable - Cover of Fall Color in Ground Layer

Description: Percent cover of fall color plants between 0 and 3 feet.

Valid values: Cover of fall color in ground layer must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where 'Height layer' is "ground"
AND 'Fall color' is TRUE for the observation species
If the sum is greater than 100.0, the Percent ground fall color plants is set to 100.0

Variables used in calculation: Height Layer, Percent Cover, Species, Fall Color

Other variables using ground plot - cover of fall color in ground layer: Ground Layer with Fall Color

Ground Plot Variable - Cover of Fall Color in Shrub Layer

Description: Percent cover of fall color plants between 3 and 10 feet.

Valid values: Cover of fall color in shrub layer must be between 0 and 100.
Units: Percent.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No. Enter the percent of the ground-cover plot that is covered by species with fall color in the shrub layer (3−10 foot).
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where 'Height layer' is "shrub"
AND 'Fall color' is TRUE for the observation species
If the sum is greater than 100.0, the Percent shrub fall color plants is set to 100.0

Variables used in calculation: Height Layer, Percent Cover, Species, Fall Color

Other variables using ground plot - cover of fall color in shrub layer: Shrub Layer with Fall Color

Ground Plot Variable - Cover of Fruiting Plants in Ground Layer

Description: Percent cover of fruiting plants between 0 and 3 feet.

Valid values: Cover of fruiting plants in ground layer must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where 'Height layer' is "ground"
AND 'Showy or edible fruit' is TRUE for the observation species
If the sum is greater than 100.0, the Percent ground fruiting is set to 100.0

Variables used in calculation: Height Layer, Species, Percent Cover, Showy or Edible Fruit

Other variables using ground plot - cover of fruiting plants in ground layer: Ground Layer with Fruits and Nuts

Ground Plot Variable - Cover of Fruiting Plants in Shrub Layer

Description: Percent cover of fruiting plants between 3 and 10 feet.

Valid values: Cover of fruiting plants in shrub layer must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: No.

NED default value: None.
User-set default: No.
Calculated: Yes.

$$\sum_{\substack{\text{ground}\\ \text{observations}}} \text{Percent cover}$$

Only use observations where 'Height layer' is "shrub"
AND 'Showy or edible fruit' is TRUE for the observation species
If the sum is greater than 100.0, the Percent shrub fruiting is set to 100.0

Variables used in calculation: Height Layer, Percent Cover, Species, Showy or Edible Fruit

Other variables using ground plot - cover of fruiting plants in shrub layer: Shrub Layer with Fruits and Nuts

Ground Plot Variable - Inventory Plot Count

Description: Number of plots in original inventory.

Valid values: Inventory plot count must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF this is the inventory snapshot
Original inventory plot count = 1
ELSE
Plot clusters containing simulated data always have one overstory plot, one understory plot, one ground plot and one transect. The value indicates how many inventory plots were combined to make the single pseudo-plot.

Tallied Ground-cover Obs Variables

Ground Observation Variable - Custom Variable 1

Description: Custom variable 1.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to first pre-established user-defined variable.

NED default value: None.
User-set default: No.
Calculated: No.

Ground Observation Variable - Custom Variable 2

Description: Custom variable 2.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to second pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Ground Observation Variable - Custom Variable 3

Description: Custom variable 3.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to third pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Ground Observation Variable - Custom Variable 4

Description: Custom variable 4.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to fourth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Ground Observation Variable - Custom Variable 5

Description: Custom variable 5.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to fifth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Ground Observation Variable - Custom Variable 6

Description: Custom variable 6.

Units: Code.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the appropriate value or code according to sixth pre-established user-defined variable.
NED default value: None.
User-set default: No.
Calculated: No.

Ground Observation Variable - Observation ID

Description: Ground observation identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the identification name or number of the ground-cover observation.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

Concatenation of the Plot ID with a colon
with the value of GROUND_OBS+1

Variables used in calculation: Plot ID

Ground Observation Variable - Height Class

Description: Height class of observation.

Valid values: Height class must be greater than or equal to zero.
Units: Code.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the user-defined height class code that best represents the approximate height of the plant.
NED default value: 0.
User-set default: Yes.
Calculated: Yes.

The value of 'Size class ranges' is parsed into the user-defined ranges of height classes. The value of 'Height of plant' is compared to each range to determine the height class.

Variables used in calculation: Height of Plant, Height Class Ranges

Other variables using ground observation - height class: Height Layer

Ground Observation Variable - Height of Plant

Description: Height of plant.

Valid values: Height of plant must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the total height of the plant from the ground to the tip of the leader or top of the plant.
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using ground observation - height of plant: Height Class, Average Shrub Layer Height, Height Layer

Ground Observation Variable - Origin of Plant

Description: Origin of plant.

Valid values: Origin of plant must be 1=“seedling”, 2=“stump sprout”, 3=“root sprout”, 4=“seedling sprout”, or 5=“other”.
Units: Code.
Variable type: Category.

Editable by user: Yes.
Tallied by user: Yes. Enter the code (1-5) that reflects the establishment origin of the ground-cover observation.
NED default value: Seedling.
User-set default: Yes.
Calculated: No.

Ground Observation Variable - Percent Cover

Description: Percent cover of this species.

Valid values: Percent cover must be between 0 and 100.
Units: Percent cover.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the percent of the fixed area plot that is covered by the species. This is used for both herbaceous and woody species.
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using ground observation - percent cover: Cover of Fruiting Plants in Shrub Layer, Cover of Fall Color in Shrub Layer, Cover of Fruiting Plants in Ground Layer, Cover of Fall Color in Ground Layer, Cover of Foliage in Shrub Layer, Percent Other Fern, Percent Inhibiting Fern, Percent Grass and Sedge, Percent Moss, Cover of Foliage in Ground Layer

Ground Observation Variable - Species

Description: Plant species.

Units: Symbol.
Variable type: Species.

Editable by user: Yes.
Tallied by user: Yes. For every plant observed, enter the species using either USDA PLANTS Database symbol (such as ACSA3 for sugar maple), the 3-digit FIA code (such as 318 for sugar maple), or a user-defined code (such as SM for sugar maple).
NED default value: NED999.
User-set default: No.
Calculated: No.

Other variables using ground observation - species: Rare Plants Present, Exotic Plants Present, Wetland Vegetation, Deciduous Shrub Layer, Coniferous Shrub Layer, Ericaceous Shrub Layer, Cover of Fruiting Plants in Shrub Layer, Cover of Fruiting Plants in Ground Layer, Flowery Shrub Layer, Flowery Ground Layer, Cover of Fall Color in Shrub Layer, Percent Other Fern, Hard Mast, Cover of Fall Color in Ground Layer, Percent Inhibiting Fern, Percent Grass and Sedge, Percent Moss, Soft Mast

Ground Observation Variable - Stem Count

Description: Stem count.

Valid values: Stem count must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the number of stems of the species. This is used for both woody and herbaceous species.
NED default value: 1.
User-set default: Yes.
Calculated: No.

Other variables using ground observation - stem count: Stems Per Unit Area

Ground-cover Obs Variables

Ground Observation Variable - Height Class

Description: Height class of observation.

Valid values: Height class must be greater than or equal to zero.
Units: Code.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the user-defined height class code that best represents the approximate height of the plant.
NED default value: 0.
User-set default: Yes.
Calculated: Yes.

The value of 'Size class ranges' is parsed into the user-defined ranges of height classes. The value of 'Height of plant' is compared to each range to determine the height class.

Variables used in calculation: Height of Plant, Height Class Ranges

Other variables using ground observation - height class: Height Layer

Ground Observation Variable - Height Layer

Description: NED height layer.

Valid values: Height layer must be 1=“ground” or 2=“shrub”.
Units: Code.
Variable type: Category.

Editable by user: No.
Tallied by user: No.
NED default value: Ground.
User-set default: No.
Calculated: Yes.

If there is a value for 'Height of plant' then the 'Height layer' is determined as follows:

IF (0.0 <= Height of plant < 3.0)
Height layer = "ground"
ELSE IF (3.0 <= Height of plant < 10.0)
Height layer = "shrub"

If there is a value for 'Height class' then the 'Height layer' is determined by parsing the value of 'Size class ranges' is into the user-defined ranges of height classes. The range corresponding to the 'Height class' is found. The 'Height layer' is then determined as follows:

IF (0.0 <= range midpoint < 3.0)
Height layer = "ground"
ELSE IF (3.0 <= range midpoint < 10.0)
Height layer = "shrub"
WHERE:

$$\text{range midpoint} = \left(\frac{\text{range maximum - range minimum}}{2.0} \right)$$

Variables used in calculation: Height Class, Height of Plant, Height Class Ranges

Other variables using ground observation - height layer: Flowery Shrub Layer, Coniferous Shrub Layer, Ericaceous Shrub Layer, Cover of Fruiting Plants in Shrub Layer, Cover of Fruiting Plants in Ground Layer, Flowery Ground Layer, Cover of Fall Color in Shrub Layer, Cover of Fall Color in Ground Layer, Cover of Foliage in Shrub Layer, Cover of Foliage in Ground Layer, Deciduous Shrub Layer

Ground Observation Variable - Stems Per Unit Area

Description: Number of stems per unit area represented by this observation.

Valid values: Stems per unit area must be greater than or equal to zero.
Units: Stems per acre or stems per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: 0.0.
User-set default: No.
Calculated: Yes.

$$\left(\frac{1.0}{\text{Ground plot size}}\right) \times \text{Stem count}$$

Variables used in calculation: Stem Count, Ground Plot Size

Transect Variables

Tallied Transect Variables

Transect Variable - High Slash

Description: Slash piles higher than 3 feet (1 meter).

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "yes" if you saw any high slash piles along the transect. Slash piles are considered high if any part of the pile is more than 3 feet high.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using transect - high slash: High Slash

Transect Variable - Interesting Tree

Description: Presence of interesting trees.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "yes" if you saw an interesting tree along the transect.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using transect - interesting tree: Interesting Tree Present

Transect Variable - Low Slash Piles Present

Description: Slash piles lower than 3 feet (1 meter).

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter "yes" if you saw any low slash piles along the transect. Slash piles are considered low if the pile is less than 3 feet high.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Other variables using transect - low slash piles present: Low Slash

Transect ID Variable

Description: Transect identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the identification name or number of the transect.
NED default value: ID.
User-set default: Yes.
Calculated: Yes.

```
IF there is only one transect in the cluster
        ID = the ID of the cluster
ELSE
        ID = the concatenation of the ClusterID with a
        colon with the value of TRANSECT + 1
```

Variables used in calculation: Cluster ID

Other variables using transect id: Transect Observation ID

Transect Length Variable

Description: Length of transect on which dead and down data were collected.

Valid values: Transect length must be greater than or equal to 50.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the distance of the transect on which dead and down log data was collected; for example, 200 feet or 75 meters. The distance should be no less than 50 feet.
NED default value: 50.0.
User-set default: Yes.
Calculated: Yes.

The value is set to the Transect length specified
in the inventory values for this stand

Variables used in calculation: Transect Length

Other variables using transect length: Volume

Transect Variable - User Comments

Description: User comments/notes.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter any additional comments about the transect.
NED default value: None.
User-set default: Yes.
Calculated: No.

Transect Variables

Inventory Transect Count Variable

Description: Number of transects in original inventory.

Valid values: Inventory transect count must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

IF this is the inventory snapshot
    Original inventory transect count = 1
ELSE
    Plot clusters containing simulated data always have one overstory plot,
    one understory plot, one ground plot and one transect. The value indicates
    how many inventory transects were combined to make the single pseudo-transect.

Transect Variable - Volume

Description: Amount of dead/down material.

Valid values: Volume must be greater than or equal to zero.
Units: Cubic feet per acre or cubic meters per hectare.
Variable type: Float.

Editable by user: No.
Tallied by user: No.
NED default value: None.
User-set default: No.
Calculated: Yes.

$$\frac{\pi^2 \times \left(\sum_{\substack{\text{dead/down} \\ \text{observations}}} \text{Count} \times \text{Diameter}^2 \right)}{8 \times \text{Transect length}} \times \frac{43560 \ {}^{\text{sq ft}}/_{\text{acre}}}{144 \ {}^{\text{sq in}}/_{\text{sq ft}}}$$

Source: Howard and Ward 1972.

Variables used in calculation: Transect Length, Diameter, Count

Other variables using transect - volume: Coarse Woody Debris

Tallied Transect Observation Variables

Dead & Down Observation Variable - Bark

Description: Presence of loose bark.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “yes” if the bark on the log is loose.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Dead & Down Observation Variable - Condition

Description: Condition of log hard/soft.

Valid values: Condition must be 1=“hard (sound)” or 2=“soft (decayed)”.
Units: Code.
Variable type: Category.

Editable by user: Yes.

Tallied by user: Yes. Enter the condition of the down logs. Codes include: 1 = hard/sound, 2 = soft/decayed.
NED default value: None.
User-set default: Yes.
Calculated: No.

Dead & Down Observation Variable - Count

Description: Observation count.

Valid values: Count must be greater than or equal to zero.
Units: Count.
Variable type: Integer.

Editable by user: Yes.
Tallied by user: Yes. Enter the number of logs of the same diameter, condition, and bark.
NED default value: 1.
User-set default: Yes.
Calculated: No.

Other variables using dead & down observation - count: Volume

Dead & Down Observation Variable - Diameter

Description: Diameter of log at point of intersect.

Valid values: Diameter must be greater than or equal to zero.
Units: Inches or centimeters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the diameter of each down log you walk over along your compass bearing between plot centers. Measure only down logs with a diameter of at least 3 inches and a length of at least 3 feet long.
NED default value: None.
User-set default: Yes.
Calculated: No.

Other variables using dead & down observation - diameter: Volume

Dead & Down Observation Variable - Species

Description: Plant species.

Units: Symbol.
Variable type: Species.

Editable by user: Yes.
Tallied by user: Yes. For every tallied log, enter the tree species using either USDA PLANTS Database symbol (such as ACSA3 for sugar maple), the 3-digit FIA code (such as 318 for sugar maple), or a user-defined code (such as SM for sugar maple).
NED default value: NED999.
User-set default: No.
Calculated: No.

Dead & Down Observation Variable - Transect Observation ID

Description: Observation identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the identification name or number of the transect observation.
NED default value: Obs.
User-set default: Yes.
Calculated: Yes.

Concatenation of the Transect ID with a colon
with the value of TRANSECT_OBS+1

Variables used in calculation: Transect ID

Variables for Buildings in the Wildland Fire Interface

Description of Building Variables

Building ID Variable

Description: Buildling identification.

Units: Text.
Variable type: String.

Editable by user: Yes.
Tallied by user: Yes. Enter the building identification name or number.
NED default value: None.
User-set default: Yes.
Calculated: Yes.

Concatenation of the string "Building: "
with the value of BUILDING + 1

Adjacent Building Variable

Description: Distance to closest adjacent building.

Valid values: Adjacent building must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the distance to the nearest building.
NED default value: 0.0.
User-set default: Yes.
Calculated: No.

Building Variable - Defensible Space

Description: Area allowing firefighters to protect structure.

Valid values: Defensible space must be greater than or equal to zero.
Units: Feet or meters.
Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. Enter the amount of space (distance) next to a building that would allow room for firefighters.
NED default value: None.
User-set default: Yes.
Calculated: No.

Building Variable - Open Foundation

Description: Open foundation on building.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the building has an open foundation type.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Open Soffits

Description: Open soffits on building.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the building has open soffits.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Single Paned, Non-Tempered Glass Windows

Description: Single paned, non-tempered glass windows.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the building has single-paned, non-tempered glass windows.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Slopes >30%

Description: Slopes >30% immediately around building.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. If the building is on a steep slope (>30%), enter the average slope immediately around the building.
NED default value: FALSE.
User-set default: Yes.
Calculated: Yes.

TRUE if 'Slope' is > 30%
FALSE if otherwise

Variables used in calculation: Slope

Building Variable - Stacked Firewood

Description: Stacked firewood near building.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.

Tallied by user: Yes. Enter “present” if stacked firewood is present near the building.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Wood Deck

Description: Wood deck connected to building.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if a wood deck is connected to the building.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Wood Fence

Description: Wood fence connected to building.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if a wood fence is connected to the building.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Wood Shingles

Description: Wood shingles or shakes on roof (Class C or not rated).

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the building has wood shingles or shakes (Class C or not rated).
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Wood Siding

Description: Wood siding on building.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the building has wood siding.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Vinyl Siding

Description: Vinyl siding or soffits.

Units: Present/absent.
Variable type: Boolean.

Editable by user: Yes.
Tallied by user: Yes. Enter “present” if the building has vinyl siding or vinyl soffits.
NED default value: FALSE.
User-set default: Yes.
Calculated: No.

Building Variable - Map X-coordinate

Description: Map x coordinate units depend on map type.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the building.
NED default value: None.
User-set default: Yes.
Calculated: No.

Building Variable - Map Y-coordinate

Description: Map y coordinate units depend on map type.

Variable type: Float.

Editable by user: Yes.
Tallied by user: Yes. This variable is used to record global positioning system coordinates of the building.
NED default value: None.
User-set default: Yes.
Calculated: No.

Appendix C - Vegetation Tables and Reports

Plan Comparison Vegetation Tables

Plans by Variables

Table Description: This is an on-screen table that has all of your plans across the top, and variables of your choice off to the left side of the table in rows. This table allows you to compare multiple variables across all of your plans for the same year in a single stand.

Columns: Plan IDs.

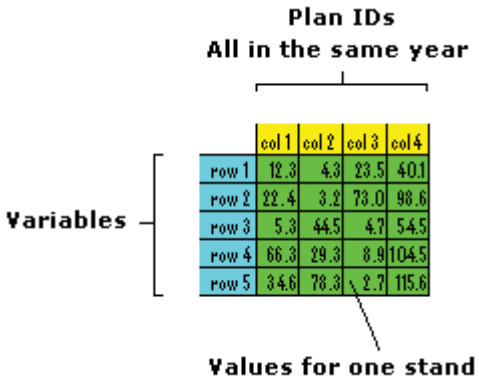
Rows: Variables (you may select as many as desired).

Option to compare multiple variables: Multiple variables may be viewed simultaneously.

Notes: You may only view one stand at a time. To view other stands, re-run the wizard. All of your plans must be viewed in the same year. To view other years, re-run the wizard. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for plan comparisons.

The choices for the variable displayed in the cells include: Aboveground Biomass, Average DBH, Average Shrub Layer Height, Basal Area, Basal Area in Saplings, Basal Area of AGS, Basal Area of UGS, Board-Foot Value, Board-Foot Volume, Canopy Closure, Coarse Root Biomass, Coniferous Midstory, Coniferous Shrub Layer, Deciduous Midstory, Deciduous Shrub Layer, Ericaceous Shrub Layer, Fall Color Ground Layer, Fall Color Trees, Foliage Biomass, Ground Layer Percent Cover, Ground Layer with Fruits and Nuts, Ground Layer with Showy Flowers, Hard Mast, Height to Bottom of Canopy, High Slash, Litter Depth, Low Slash, Medial DBH, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Mixed Midstory, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume Net Pulpwood Volume, Net Sawlog Cubic Volume, Number of Big Trees Per Unit Area, Percent Basal Area Commercial, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Hardwoods, Percent Basal Area High Value, Percent Cover of Leaf Litter, Percent Cover Rock, Percent Open Plots, Percent Plots in Lg. Saw., Percent Plots In Pole, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots In Sm. Saw., Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Plots with Interesting Trees, Percent Regeneration Sprout, Pulpwood Cord Volume, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Quadratic Mean DBH, Relative Density, Relative Density of AGS, Relative Density of UGS, Sawlog Cubic Volume, Shrub Layer Percent Cover, Shrub Layer with Fall Color, Shrub Layer with Fruits and Nuts, Shrubs with Showy Flowers, Soft Mast, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Timber Value of the Stand, Total Biomass, Total Midstory, Trees with Fruits and Nuts, Trees with Showy Flowers.

Table diagram:



Plans by Years

Table Description: This is an on-screen table that has all of your plans across the top, and all years off to the left side of the table in rows. This table allows you to see how single variables might change over time, across all of your plans, in a single stand.

Columns: Plan IDs.

Rows: Years.

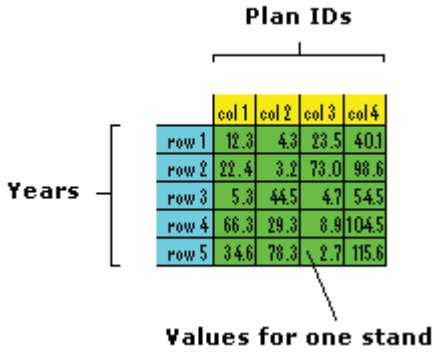
Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: You may only view one variable at a time. To view other variables, re-run the wizard. You may only view one stand at a time. To view other stands, re-run the wizard. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for plan comparisons.

The choices for the variable displayed in the cells include: Canopy Closure, Height to Bottom of Canopy, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Open Plots, Percent Regeneration Sprout, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Pole, Percent Plots in Sm. Saw., Percent Plots in Lg. Saw., Average DBH, Medial DBH, Quadratic Mean DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Hard Mast, Soft Mast, Number of Big Trees Per Unit Area, Percent Plots with Interesting Trees, Fall Color Trees, Trees with Showy Flowers, Trees with Fruits and Nuts, Deciduous Midstory, Coniferous Midstory, Mixed Midstory, Total Midstory, Shrub Layer Percent Cover, Ericaceous Shrub Layer, Coniferous Shrub Layer, Deciduous Shrub Layer, Shrub Layer with Fall Color, Shrubs with Showy Flowers, Shrub Layer with Fruits and Nuts, High Slash, Ground Layer Percent Cover, Fall Color Ground Layer, Ground Layer with Showy Flowers, Ground Layer with Fruits and Nuts, Low Slash, Percent Cover of Leaf Litter, Percent Cover Rock, Litter Depth, Average Shrub Layer Height, Basal Area, Basal Area of Ags, Basal Area of Ugs, Basal Area in Saplings, Percent Basal Area Hardwoods, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Commercial, Percent Basal

Area High Value, Relative Density, Relative Density of Ags, Relative Density of UGS, Board-Foot Volume, Net Board-Foot Volume, Merchantable Cubic Volume, Net Merchantable Cubic Volume, Pulpwood Volume, Net Pulpwood Volume, Sawlog Cubic Volume, Net Sawlog Cubic Volume, Timber Value of the Stand, Pulpwood Value, Board-Foot Value, Merchantable Stem Bark Biomass, Foliage Biomass, Merchantable Stem Wood Biomass, Coarse Root Biomass, Aboveground Biomass, Total Biomass, Merchantable Cord Volume, Net Merchantable Cord Volume, Merchantable Ton Volume, Net Merchantable Ton Volume, Pulpwood Cord Volume, Net Pulpwood Cord Volume, Pulpwood Ton Volume, Net Pulpwood Ton Volume.

Table diagram:



Plans by Stands

Table Description: This is an on-screen table that has all of your plans across the top, and all of your stands off to the left side of the table in rows. This table allows you to compare a single variable in all of your stands in all of your plans in a single year.

Columns: Plan IDs.

Rows: Stands.

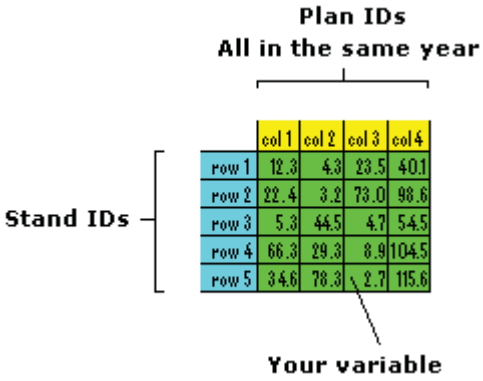
Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: You may only view one variable at a time. To view other variables, re-run the wizard. You may only view one year at a time. To view other years, re-run the wizard. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for plan comparisons.

The choices for the variable displayed in the cells include: Canopy Closure, Height to Bottom of Canopy, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Open Plots, Percent Regeneration Sprout, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Pole, Percent Plots in Sm. Saw., Percent Plots In Lg. Saw., Average DBH, Medial DBH, Quadratic Mean DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Hard Mast, Soft Mast, Number of Big Trees Per Unit Area,

Percent Plots with Interesting Trees, Fall Color Trees, Trees with Showy Flowers, Trees with Fruits and Nuts, Deciduous Midstory, Coniferous Midstory, Mixed Midstory, Total Midstory, Shrub Layer Percent Cover, Ericaceous Shrub Layer, Coniferous Shrub Layer, Deciduous Shrub Layer, Shrub Layer with Fall Color, Shrubs with Showy Flowers, Shrub Layer with Fruits and Nuts, High Slash, Ground Layer Percent Cover, Fall Color Ground Layer, Ground Layer with Showy Flowers, Ground Layer with Fruits and Nuts, Low Slash, Percent Cover of Leaf Litter, Percent Cover Rock, Litter Depth, Average Shrub Layer Height, Basal Area, Basal Area of AGS, Basal Area of UGS, Basal Area in Saplings, Percent Basal Area Hardwoods, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Commercial, Percent Basal Area High Value, Relative Density, Relative Density of AGS, Relative Density of UGS, Board-Foot Volume, Net Board-Foot Volume, Merchantable Cubic Volume, Net Merchantable Cubic Volume, Pulpwood Volume, Net Pulpwood Volume, Sawlog Cubic Volume, Net Sawlog Cubic Volume, Timber Value of the Stand, Pulpwood Value, Board-Foot Value, Merchantable Stem Bark Biomass, Foliage Biomass, Merchantable Stem Wood Biomass, Coarse Root Biomass, Aboveground Biomass, Total Biomass, Merchantable Cord Volume, Net Merchantable Cord Volume, Merchantable Ton Volume, Net Merchantable Ton Volume, Pulpwood Cord Volume, Net Pulpwood Cord Volume, Pulpwood Ton Volume, Net Pulpwood Ton Volume.

Table diagram:



Stands by Variables

Table Description: This is an on-screen table that has all of your stands across the top, and variables of your choice off to the left side of the table in rows. This table allows you to compare multiple variables in all of your stands, within a single plan in the same year.

Columns: Stand IDs.

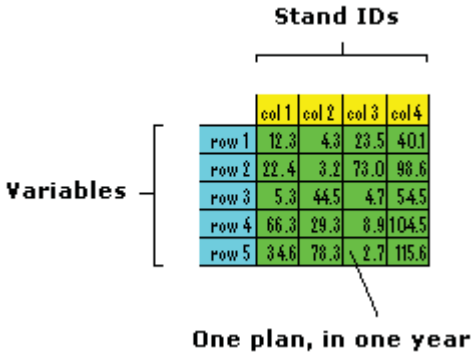
Rows: Variables (you may select as many as desired).

Option to compare multiple variables: Multiple variables may be viewed simultaneously.

Notes: You may view as many variables as desired. You may only view one plan at a time. To view other plans, re-run the wizard. All of your stands must be viewed in the same year. To view other years, re-run the wizard. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for plan comparisons.

The choices for the variable displayed in the cells include: Aboveground Biomass, Average DBH, Average Shrub Layer Height, Basal Area, Basal Area in Saplings, Basal Area of AGS, Basal Area of UGS, Board-Foot Value, Board-Foot Volume, Canopy Closure, Coarse Root Biomass, Coniferous Midstory, Coniferous Shrub Layer, Deciduous Midstory, Deciduous Shrub Layer, Ericaceous Shrub Layer, Fall Color Ground Layer, Fall Color Trees, Foliage Biomass, Ground Layer Percent Cover, Ground Layer with Fruits and Nuts, Ground Layer with Showy Flowers, Hard Mast, Height to Bottom of Canopy, High Slash, Litter Depth, Low Slash, Medial DBH, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Mixed Midstory, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume Net Pulpwood Volume, Net Sawlog Cubic Volume, Number of Big Trees Per Unit Area, Percent Basal Area Commercial, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Hardwoods, Percent Basal Area High Value, Percent Cover of Leaf Litter, Percent Cover Rock, Percent Open Plots, Percent Plots in Lg. Saw., Percent Plots in Pole, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Sm. Saw., Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Plots with Interesting Trees, Percent Regeneration Sprout, Pulpwood Cord Volume, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Quadratic Mean DBH, Relative Density, Relative Density of AGS, Relative Density of UGS, Sawlog Cubic Volume, Shrub Layer Percent Cover, Shrub Layer with Fall Color, Shrub Layer with Fruits and Nuts, Shrubs with Showy Flowers, Soft Mast, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Timber Value of the Stand, Total Biomass, Total Midstory, Trees with Fruits and Nuts, Trees with Showy Flowers.

Table diagram:



Stands by Years

Table Description: This is an on-screen table that has all of your stands across the top, and all years off to the left side of the table in rows. This table allows you to see how a single variable might change over time in all of your stands in single plan.

Columns: Stand IDs.

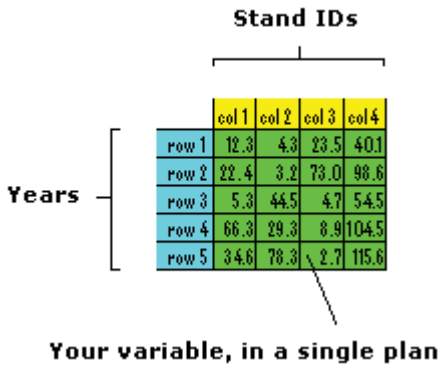
Rows: Years.

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: You may only view one variable at a time. To view other variables, re-run the wizard. You may only view one plan at a time. To view other plans, re-run the wizard. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for plan comparisons.

The choices for the variable displayed in the cells include: Canopy Closure, Height to Bottom of Canopy, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Open Plots, Percent Regeneration Sprout, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Pole, Percent Plots in Sm. Saw., Percent Plots in Lg. Saw., Average DBH, Medial DBH, Quadratic Mean DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Hard Mast, Soft Mast, Number of Big Trees Per Unit Area, Percent Plots with Interesting Trees, Fall Color Trees, Trees with Showy Flowers, Trees with Fruits and Nuts, Deciduous Midstory, Coniferous Midstory, Mixed Midstory, Total Midstory, Shrub Layer Percent Cover, Ericaceous Shrub Layer, Coniferous Shrub Layer, Deciduous Shrub Layer, Shrub Layer with Fall Color, Shrubs with Showy Flowers, Shrub Layer with Fruits and Nuts, High Slash, Ground Layer Percent Cover, Fall Color Ground Layer, Ground Layer with Showy Flowers, Ground Layer with Fruits and Nuts, Low Slash, Percent Cover of Leaf Litter, Percent Cover Rock, Litter Depth, Average Shrub Layer Height, Basal Area, Basal Area of AGS, Basal Area of UGS, Basal Area in Saplings, Percent Basal Area Hardwoods, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Commercial, Percent Basal Area High Value, Relative Density, Relative Density of AGS, Relative Density of UGS, Board-Foot Volume, Net Board-Foot Volume, Merchantable Cubic Volume, Net Merchantable Cubic Volume, Pulpwood Volume, Net Pulpwood Volume, Sawlog Cubic Volume, Net Sawlog Cubic Volume, Timber Value of the Stand, Pulpwood Value, Board-Foot Value, Merchantable Stem Bark Biomass, Foliage Biomass, Merchantable Stem Wood Biomass, Coarse Root Biomass, Aboveground Biomass, Total Biomass, Merchantable Cord Volume, Net Merchantable Cord Volume, Merchantable Ton Volume, Net Merchantable Ton Volume, Pulpwood Cord Volume, Net Pulpwood Cord Volume, Pulpwood Ton Volume, Net Pulpwood Ton Volume.

Table diagram:



Variables by Years

Table Description: This is an on-screen table that has the variables of your choice across the top, and all years off to the left side of the table in rows. This table allows you to see how multiple variables might change over time in a single stand within a single plan.

Columns: Variables (you may select as many variables as desired).

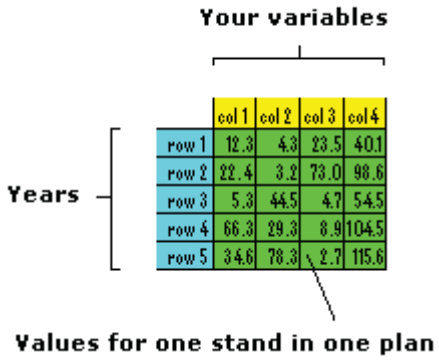
Rows: Years.

Option to compare multiple variables: Multiple variables may be viewed simultaneously.

Notes: You may view as many variables as desired. You may only view one stand at a time. To view other stands, re-run the wizard. You may only view one plan at a time. To view other plans, re-run the wizard. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for plan comparisons.

The choices for the variable displayed in the cells include: Aboveground Biomass, Average DBH, Average Shrub Layer Height, Basal Area, Basal Area in Saplings, Basal Area of AGS, Basal Area of UGS, Board-Foot Value, Board-Foot Volume, Canopy Closure, Coarse Root Biomass, Coniferous Midstory, Coniferous Shrub Layer, Deciduous Midstory, Deciduous Shrub Layer, Ericaceous Shrub Layer, Fall Color Ground Layer, Fall Color Trees, Foliage Biomass, Ground Layer Percent Cover, Ground Layer with Fruits and Nuts, Ground Layer with Showy Flowers, Hard Mast, Height to Bottom of Canopy, High Slash, Litter Depth, Low Slash, Medial DBH, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Mixed Midstory, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume Net Pulpwood Volume, Net Sawlog Cubic Volume, Number of Big Trees Per Unit Area, Percent Basal Area Commercial, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Hardwoods, Percent Basal Area High Value, Percent Cover of Leaf Litter, Percent Cover Rock, Percent Open Plots, Percent Plots in Lg. Saw., Percent Plots in Pole, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Sm. Saw., Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Plots with Interesting Trees, Percent Regeneration Sprout, Pulpwood Cord Volume, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Quadratic Mean DBH, Relative Density, Relative Density of AGS, Relative Density of UGS, Sawlog Cubic Volume, Shrub Layer Percent Cover, Shrub Layer with Fall Color, Shrub Layer with Fruits and Nuts, Shrubs with Showy Flowers, Soft Mast, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Timber Value of the Stand, Total Biomass, Total Midstory, Trees with Fruits and Nuts, Trees with Showy Flowers.

Table diagram:



Management Unit Vegetation Tables

Table Wizard for Management Unit Totals

Table Description: This is an on-screen table of your own design, providing for analysis of a variable at the management unit level for all of your stands combined. Possible variables only include those that can be totalled across stands. This is because the values in the table represent a summation over all stands in the management unit. The variable you select will be totalled for each stand individually by multiplying the per unit area value times stand area, resulting in a management unit total.

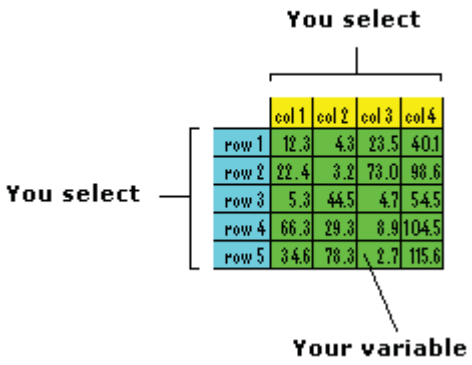
Columns: You select a variable to break down your data into categories such as species, timber quality, crown class, etc.

Rows: You select a variable to break down your data into categories such as species, timber quality, crown class, etc.

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the point in time to view your management unit. Decide how you want to organize the table by selecting a variable for your columns, and another variable for your rows.

Table diagram:



Species by Size Class

Table Description: This is an on-screen table that has all of your species across the top, and size classes off to the left side of the table in rows. Values in the table represent a summation over all stands in the management unit.

Columns: Species (you may display species according to some form of identification or a species attribute).

Rows: Size class (the default selection is to display diameters by major size classes).

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the point in time to view your management unit. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for management unit totals.

- **Options for the contents of the table include:** Aboveground Biomass, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Pulpwood Value, Stem Bark Biomass, Stem Wood Biomass, Total Biomass, If Understory Observations are Included, Only The Following Will Be Available: Aboveground Biomass, Coarse Root Biomass, Foliage Biomass, Total Biomass.
- **Options for the row headings include:** Midpoint of Range (Diameter Classes Must Be Defined), Entire Range (Diameter Classes Must Be Defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw)
- **Options for the column headings include:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Table diagram:

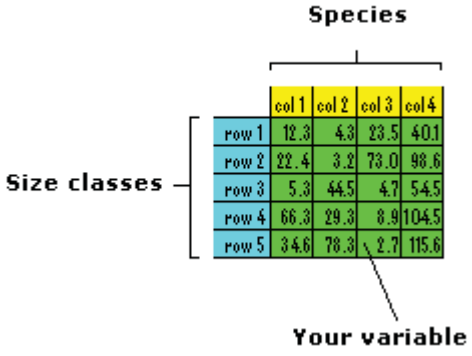


Table Wizard for Comparing Stands

Table Description: This is an on-screen table of your own design, providing for a variety of ways to analyze a single variable across your stands.

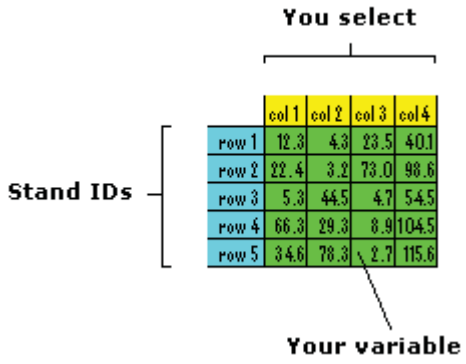
Columns: You select a variable to break down your data into categories such as species, timber quality, crown class, etc.

Rows: Stand IDs (default) (you may elect to have stands in columns if desired).

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the point in time to view your management unit. When you specify a variable for the table, you have three choices for how to represent the variable (As a Per Area Value, As a Percent of the Stand, or As a Percent of The Management Unit).

Table diagram:



Species by Stand

Table Description: This is an on-screen table that will help you compare stands by species, where species are in columns across the top, and all of your stands off to the left side of the table in rows.

Columns: Species (you may select species ID or attributes).

Rows: Stand IDs.

Option to compare multiple variables: Only one variable can be viewed at a time.

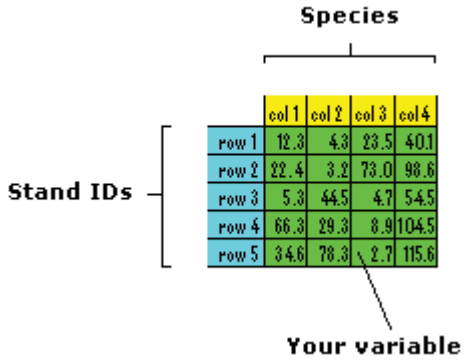
Notes: Select the point in time to view your management unit. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for comparing stands.

- **Options for the contents of the table depend on the selections of plot types to include. The possible variables include:** Aboveground Biomass, Average DBH, Basal Area, Board-Foot Value, Coarse Root Biomass, Count, Dollar Value, Foliage Biomass, Gross Board-Foot

Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.

- **Options for the row headings include:** Accessibility, Compartment, Ecological Land Type, Forest Type, Land Cover Type, Operability, Site Index Species, Size Class Slope Shape, Stand ID, Topographic Position.
- **Options for the column headings include:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.\

Table diagram:



Size Class by Stand

Table Description: This is an on-screen table that has diameter-size classes in columns across the top, and all of your stands off to the left side of the table in rows. Size classes are defined in the description of stand variables in the Inventory chapter.

Columns: Size classes (the default selection is to display diameters by major size classes).

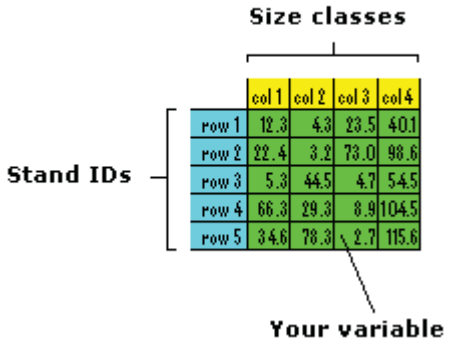
Rows: Stand IDs.

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the point in time to view your management unit. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for comparing stands.

- **Options for the contents of the table depend on the plot types selected. Variable choices include:** Aboveground Biomass, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- **Options for the row headings include:** Accessibility, Compartment, Ecological Land Type, Forest Type, Land Cover Type, Operability, Site Index Species, Size Class Slope Shape, Stand ID, Topographic Position.
- **Options for the column headings include:** Midpoint of Range (Diameter Classes Must Be Defined), Entire Range (Diameter Classes Must Be Defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw).

Table diagram:



Stands by Variables Table

Table Description: This is an on-screen table that allows you to compare as many variables as desired across all of your stands.

Columns: Variables (you may select as many variables as desired).

Rows: Stand IDs (default) (you may elect to have stands in columns if desired).

Option to compare multiple variables: Multiple variables may be viewed simultaneously.

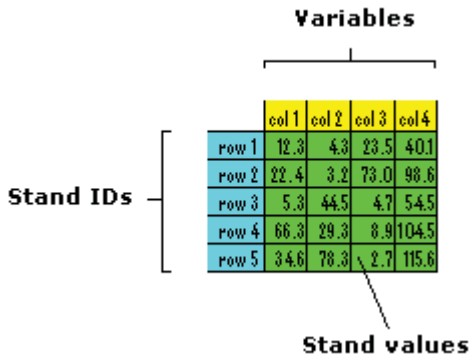
Notes: Select the point in time to view your management unit. Decide whether to display stands in rows or columns, and then select your desired variables.

Variables in the table can include any combination of the following: Aboveground Biomass, Accessibility, Adjacent to Water, Aspect, Average DBH, Average Haul Distance, Average Shrub Layer Height, Basal Area, Basal Area in Saplings, Basal Area of AGS, Basal Area of UGS,

Board-Foot Value, Board-Foot Volume, Building List, Canopy Closure, Caves, Coarse Root Biomass, Coarse Woody Debris, Coarse Woody Debris in Water, Compartment, Coniferous Midstory, Coniferous Shrub Layer, Contains a Riparian, Contains a Wetland, Dead Cavity Tree, Deciduous Midstory, Deciduous Shrub Layer, Ecological Land Type, Effective Age, Elevation, Ericaceous Shrub Layer, Exotics, Fall Color Ground Layer, Fall Color Trees, Feature to Screen, Feature to Show, Foliage Biomass, Forest Type, Ground Layer Percent Cover, Ground Layer with Fruits and Nuts, Ground Layer with Showy Flowers, Hard Mast, Height to Bottom of Canopy, High Perch, High Slash, Land Cover Type, Litter Depth, Live Cavity Tree, Loose Soils, Low Perch, Low Slash, Medial DBH, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Mixed Midstory, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume Net Pulpwood Volume, Net Sawlog Cubic Volume, Number of Big Trees Per Unit Area, Number of Plot Size Classes, Old Growth, Operability, Percent Area Riparian, Percent Area Wetland, Percent Basal Area Commercial, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Hardwoods, Percent Basal Area High Value, Percent Cover of Leaf Litter, Percent Cover Rock, Percent Open Plots, Percent Plots in Lg. Saw., Percent Plots in Pole, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Sm. Saw., Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Plots with Interesting Trees, Percent Regeneration Sprout, Permanent Ponds, Pulpwood Cord Volume, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Q Factor, Quadratic Mean DBH, Rare, Relative Density, Relative Density of AGS, Relative Density of UGS, Riparian, Roaded, Rock Crevices, Rock Piles, Sawlog Cubic Volume, Seeps, Shrub Layer Percent Cover, Shrub Layer with Fall Color, Shrub Layer with Fruits and Nuts, Shrubs with Showy Flowers, Site Index, Site Index Species, Size Class, Slope, Slope Shape, Soft Mast, Stand Area, Stand ID, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Stream, Temporary Ponds, Timber Value of the Stand, Topographic Position, Total Biomass, Total Midstory, Trees with Fruits and Nuts, Trees with Showy Flowers, Unique Features, Wetland, Year of Maturity, Year of Origin.

Variables in this report are present only if a value exists for them in the NED database. If a particular variable is not present in your report, but is listed on the ‘Enter/Edit Inventory’, that usually indicates that no data is present for the variable.

Table diagram:



Plant Species Variable Table

Table Description: This is an on-screen table that shows selected species attributes either across the top (columns) or along the side (rows), for the species in your data set.

Columns: Species attributes (these are attributes of your species).

Rows: Species (default) (you may display species according to some form of identification or a species attribute, or also display species in columns if desired).

Option to compare multiple variables: Multiple variables may be viewed simultaneously.

Notes: Select the point in time to view your management unit. You may view as many species attributes as desired, which generally includes species identification, biological traits, and timber prices. You may choose whether to list the species that occur in your overstory, understory, ground cover, or coarse woody debris transect data.

Names: Symbol, User Species Code, User Label, Category, Order Name, Family Name.

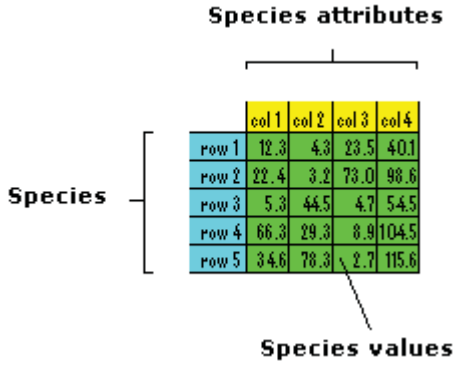
Characteristics: Growth Form, Shade Tolerance, Evergreen, Mast Type, Wetland Species, Ericaceous, Exotic, Rare, Showy Flowers, Fall Color, Showy Bark, Showy or Edible Fruit.

Timber characteristics: Cubic-Foot Correction Factor, Boardfoot Volume Correction Factor, Tons Per Cord, Timber Value Class, Girard Form Class, Hardwood or Softwood.

Sawlog prices: Price for Veneer, Price for Grade 1 Sawlogs, Price for Grade 2 Sawlogs, Price for Grade 3 Sawlogs, Price for Subfactory Sawlogs.

Pulpwood prices: Price for Whole Pulpwood, Price for Chipped Pulpwood, Price for Boltwood, Price for Firewood, Price for Local Use.

Table diagram:



Diversity Index Table between Stands

Table Description: This is an on-screen table that of similarity (beta-diversity) values for your management unit. Five similarity measures can be reported. You may choose either to report all measures, or one at a time. If you choose to report all measures, the table will show an average similarity value for each measure, along with the minimum and maximum values observed between any two stand comparisons. The average is based on all of the possible comparisons between any two stands. If you choose to report only measure at a time, the table includes more detail and will display the similarity values between all stands, as well as the average value. This allows you to evaluate the similarity of any two stands.

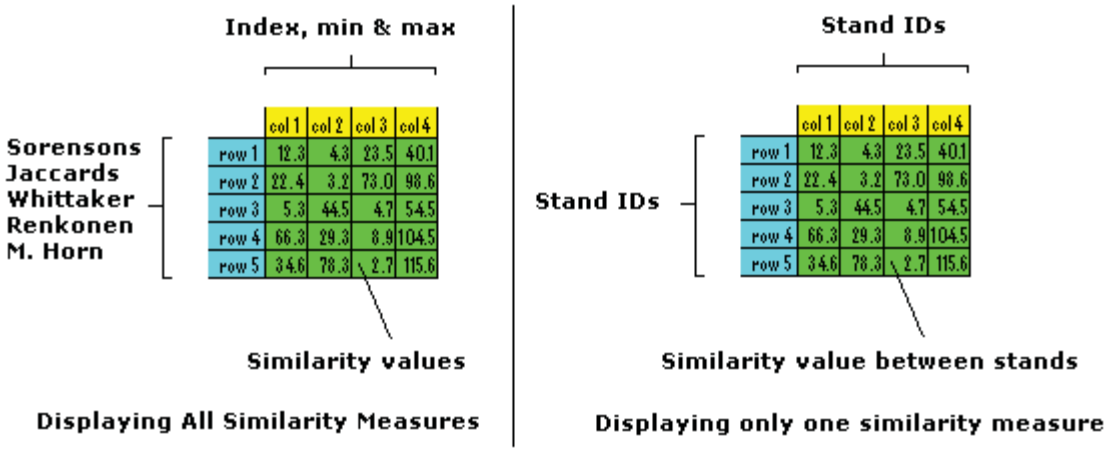
Columns: If choose to display all similarity measures, they will appear in columns. If you choose to display a single measure, stand IDs will appear in columns.

Rows: If choose to display all similarity measures, the labels for each measure will appear in rows. If you choose to display a single measure, stand IDs will appear in rows.

Option to compare multiple variables: Multiple variables may be viewed simultaneously.

Notes: Select the point in time to view your management unit. Decide whether to display all similarity measures, or select just one. For similarity measures based on abundance, select the appropriate variable to use as the abundance values (i.e., Basal Area, Percent Cover, Stems Per Area).

Table diagram:



Stand Vegetation Tables

Table Wizard for Single Stand Tables

Table Description: This is an on-screen table of your own design, providing for a variety of ways to analyze data for one stand at a time.

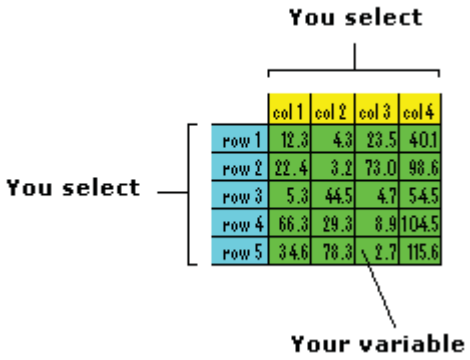
Columns: You select a variable to break down your data into categories such as species, timber quality, crown class, etc.

Rows: You select a variable to break down your data into categories such as species, timber quality, crown class, etc.

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. Decide how you want to organize the table by selecting a variable for your columns, and another variable for your rows.

Table diagram:



Species x Diameter

Table Description: This is an on-screen table that will help you analyze a variety of data by species and diameter, for a single stand.

Columns: Species (you may select a species attribute or form of identification).

Rows: Diameter (you may display diameters by major size classes or any interval desired).

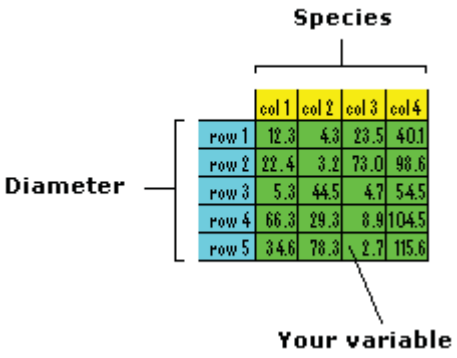
Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for single stand tables.

- **Options for the contents of the table include the following:** Aboveground Biomass, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.

  The list of variables will change depending on which plot data is included (i.e., Overstory, Understory, or both). If more than one plot type is chosen, the only variables available will be those that exist in all selected plot types.
- **Options for the row headings include the following:** Midpoint of Range (Diameter Classes Must Be Defined), Entire Range (Diameter Classes Must Be Defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw).
- **Options for the column headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Table diagram:



Custom Variable x Species

Table Description: This is an on-screen table that will help you analyze data according to your custom user codes (i.e., data variables that you may have defined such as “ice storm damage” or “presence of beech bark disease”), by species, for a single stand.

Columns: Custom variables.

Rows: Species (you may select a species attribute or form of identification).

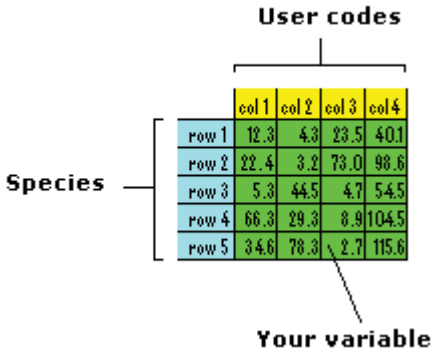
Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for single stand tables.

- **Options for the contents of the table include the following:** Aboveground Biomass, Average DBH, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.

  The list of variables will change depending on which plot data is included (i.e., Overstory, Understory, or Ground). If more than one plot type is chosen, the only variables available will be those that exist in all selected plot types.
- **Options for the row headings:** You must choose one of the six custom variables. The custom variables can be re-named using the Custom Variable Definitions in the Enter/Edit Inventory module.
- **Options for the column headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Table diagram:



Product by Species

Table Description: This is an on-screen table that will help you analyze a variety of data by timber product and species, for a single stand.

Columns: Products (these are the timber products assigned to the merchantable portion of the tree).

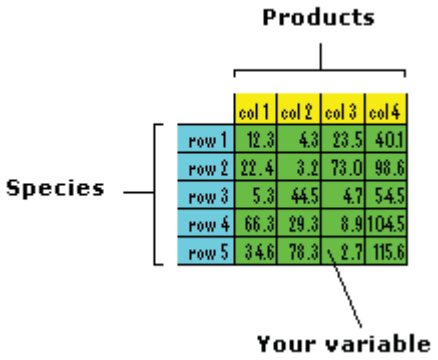
Rows: Species (you may display species according to some form of identification or a species attribute).

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for single stand tables.

- **Options for the contents of the table include the following:** Aboveground Biomass, Average DBH, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- **The row headings:** These will be valid values of the Log product which are as follows: Veneer, Sawlog, Grade 1 Sawlog, Grade 2 Sawlog, Grade 3 Sawlog, Subfactory Sawlog, Pulpwood, Chipped Pulpwood, Whole Pulpwood, Boltwood, Firewood, Local Use.
- **Options for the column headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Table diagram:



Custom Variable x Diameter

Table Description: This is an on-screen table that will help you analyze data according to your custom user codes (i.e., data variables that you may have defined such as “ice storm damage” or “presence of beech bark disease”), by diameter, for a single stand.

Columns: Custom variables.

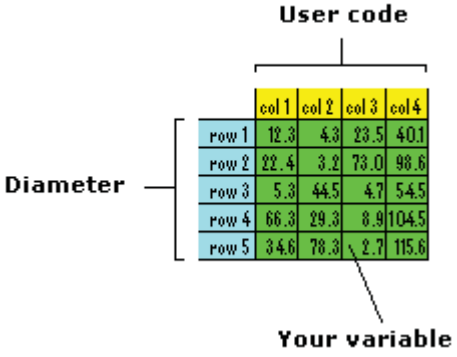
Rows: Diameter (you may display diameters by major size classes or any interval desired).

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for single stand tables.

- **Options for the contents of the table include the following:** Aboveground Biomass, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- **Options for the row headings include the following:** Midpoint of Range (diameter classes must be defined), Entire Range (diameter classes must be defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw).
- **Options for the column headings:** You must choose one of the six custom variables. The custom variables can be re-named using the Custom Variable Definitions in the Enter/Edit Inventory module.

Table diagram:



Product by Diameter

Table Description: This is an on-screen table that will help you analyze a variety of data by product and diameter, for a single stand.

Columns: Products (these are the timber products assigned to the merchantable portion of the tree).

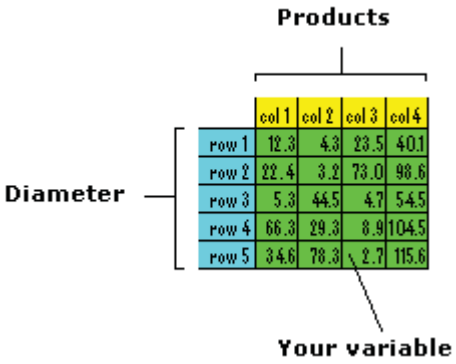
Rows: Diameter (you may display diameters by major size classes or any interval desired).

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for single stand tables.

- **Options for the contents of the table include the following:** Aboveground Biomass, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Pulpwood Value, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- **Options for the row headings include the following:** Midpoint of Range (diameter classes must be defined), Entire Range (diameter classes must be defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw).
- **The column headings:** These will be valid values of the Log product which are as follows: Veneer, Sawlog, Grade 1 Sawlog, Grade 2 Sawlog, Grade 3 Sawlog, Subfactory Sawlog, Pulpwood, Chipped Pulpwood, Whole Pulpwood, Boltwood, Firewood, and Local Use.

Table diagram:



Height Class by Species

Table Description: This is an on-screen table that will help you analyze the abundance of species occurring in each of your custom height classes (i.e., codes you used in the field to approximate height), for a single stand. You may display stems per area or percent cover.

Columns: Height classes.

Rows: Species (you may display species according to some form of identification or a species attribute).

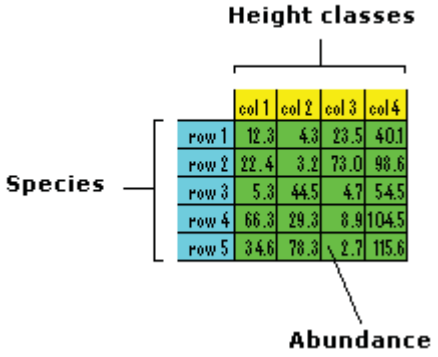
Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for single stand tables.

- **Options for the contents of the table include the following:** Aboveground Biomass, Average DBH, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.

  The list of variables will change depending on which plot data is included (i.e., Overstory, Understory, or Ground). If more than one plot type is chosen, the only variables available will be those that exist in all selected plot types.
- **The row headings:** These will be valid values of the Height class which are defined by the user in the Inventory settings for the stand.
- **Options for the column headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Table diagram:



Height Layer by Species

Table Description: This is an on-screen table that will help you analyze the abundance of species occurring in the NED-calculated height layer (ground and shrub layers only), for a single stand. You may display stems per area or percent cover.

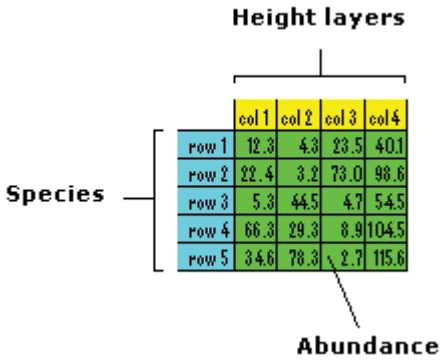
Columns: Height layer (comprised of the ground layer (0−3 feet) and shrub layer (3−10 feet) only.

Rows: Species (you may display species according to some form of identification or a species attribute).

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for single stand tables.

Table diagram:



Plot Cluster by Species

Table Description: This is an on-screen table that will help you analyze a variety of data in your plot-clusters, by species, for a single stand. Each cluster represents the average of all plots in the cluster.

Columns: Plot cluster IDs.

Rows: Species (you may display species according to some form of identification or a species attribute).

Option to compare multiple variables: Only one variable can be viewed at a time.

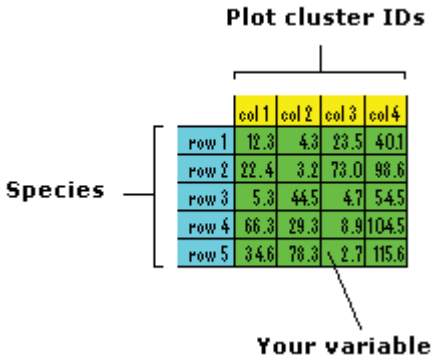
Notes: Select the stand of your choice at a valid point in time along the planning cycle. The choices for columns and rows are fixed. If you need to switch rows and columns, try the table wizard for single stand tables.

- **Options for the contents of the table depend on the selections of plot types to include. The possible variables include the following:** Aboveground Biomass, Average DBH, Basal Area, Board-Foot Value, Coarse Root Biomass, Count, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH,Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord

Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass, Volume.

- **Options for the row headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Table diagram:



Q-factor and DBH Averages

Table Description: This is an on-screen table of several calculated average diameter values (e.g., arithmetic, quadratic, medial) as well as the Q-factor, by species, for a single stand.

Columns: Species (default) (you may elect to have species in rows if desired).

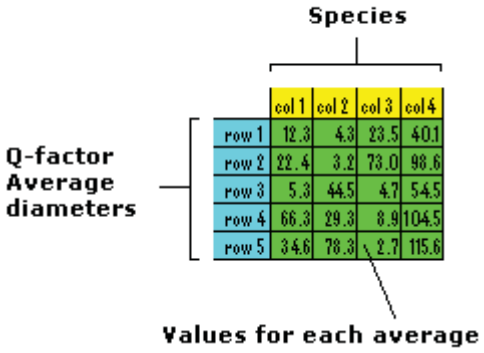
Rows: Averages and Q-factor.

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. You need to specify 1-inch or 2-inch size classes for the calculation of Q-factor.

- **Composition**: Basal Area, Stems Per Unit Area
- **Diameters**: Medial DBH, Merchantable Medial DBH, Quadratic Mean DBH, Merchantable Quadratic Mean DBH, Average DBH
- **Structure**: Q-factor
- **Relative density**: Relative density
- **Volumes**: Cubic Volume, Net Cubic Volume, Net Pulpwood Volume, Board-Foot Volume, Net Board-Foot Volume
- **Values**: Pulpwood Value, Board-Foot Value, Dollar Value
- **Biomass**: Coarse Root Biomass, Merchantable Stem Wood Biomass, Merchantable Stem Bark Biomass, Foliage Biomass, Aboveground Biomass, Total Biomass

Table diagram:



Plant Species Occurrence and Abundance

Table Description: This is an on-screen table that displays species abundance and occurrence according to density, frequency, and dominance. You can also display any one of these measures by species and a row variable (e.g., dbh, Height) of your choosing.

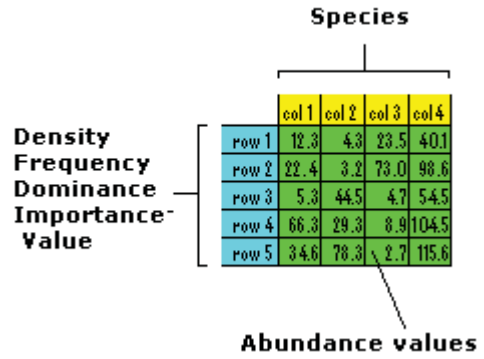
Columns: Species (default) (you may elect to have species in rows if desired).

Rows: Optional. A row item is not required. If not used, you will see a table of density, frequency, and abundance by species.

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. You can decide whether you want to display all measures of abundance, by species, or just one measure of abundance according to species and a row variable.

Table diagram:



Inventory Statistics

Table Description: This is an on-screen table of confidence intervals and related statistics for variables that you select. The table will display the value of your variables in each cluster in the stand.

Columns: Variables (default). You may select as many variables as desired.

Rows: Cluster IDs and confidence interval statistics. You may select 90% or 95% confidence interval, or specify your own.

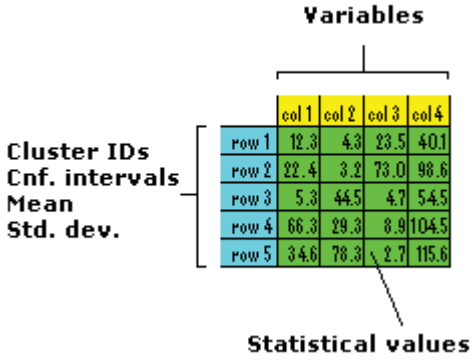
Option to compare multiple variables: Multiple variables may be viewed simultaneously.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. Select the variables you want to calculate statistics for, and decide whether you want the variables to appear in columns or rows (columns is recommended to minimize scrolling).

The variables to be analyzed must be selected by the user. The report will include values for each variable at the plot level, along with summary statistics such as the Minimum Value, Maximum Value, Mean, Variance, Standard Deviation, and Stand Error. Variables available for analysis include the following: Stems Per Unit Area, Basal Area, Relative Density, Board-Foot Volume, Net Board-Foot Volume, Merchantable Cubic Volume, Net Merchantable Cubic Volume, Pulpwood Volume, and Net Pulpwood Volume.

You may choose any combination of these variables. If confidence levels are selected, additional tables are generated for each confidence interval. The table includes mean lower and upper limit and the estimated number of plots to be within 15% and within 10% of the true mean value.

Table diagram:



Cluster Value Table

Table Description: This is an on-screen table that will display the value of your selected variables in each cluster in the stand. Some variables such as basal area and stems per unit area are not available for this table. As an alternative, if you wish to view these variables along with others, try the inventory statistics table.

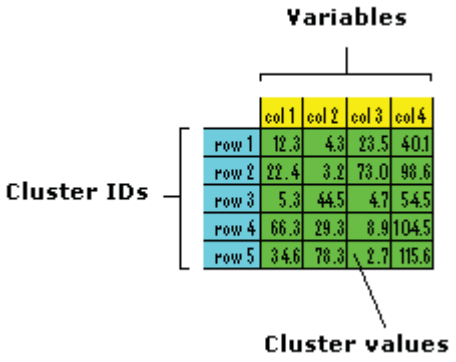
Columns: Variables (you may select as many plot-cluster variables as desired).

Rows: Plot cluster IDs (default) (you may elect to have cluster IDs in columns if desired).

Option to compare multiple variables: Multiple variables may be viewed simultaneously.

Notes: Select the stand of your choice at a valid point in time along the planning cycle. Decide how you want to organize the table by selecting variables to display in either columns or rows.

Table diagram:



Plan Report Descriptions

Plan Summary Report

Report Description: A list of the treatments established in the plans.

About this report: For each plan a table is displayed listing the simulators used for each stand. The treatments used in the plan are listed both by stand and by year.

Predicted Timber Product Yield Report

Report Description: Timber product yield for the different plans.

About this report: A table is displayed for each stand showing timber yields each plan would produce for all years in the plans.

Variables in the table include the following: Net Merchantable Cubic Volume, Net Pulpwood Volume, Net Board-Foot Volume, Timber Value of the Stand.

Predicted Stand Development Report

Report Description: Comparison tables of the predicted stand structure for the different plans.

About this report: A table is displayed for each stand showing stand variables for all years in the plans.

Variables in the table include the following: Stems Per Unit Area, Basal Area, Relative Density, Average DBH, Merchantable Medial DBH, Effective Age, Net Merchantable Cubic Volume, Net Pulpwood Volume, Net Board-Foot Volume, Timber Value of the Stand.

Plan Comparison of Variables Report

Report Description: Comparison tables of user selected variable across the different plans.

About this report: This report allows the user to configure a table to compare values across plans, stands and years. The user chooses the contents (i.e., Plans, Stands, and Years) for the rows and columns. A separate table will be created for whatever row/column header is not selected. For example, if Plans is selected for the rows, and Stands is selected for the columns, a table will be created for each of the Years.

The choices for the variable displayed in the cells include the following: Aboveground Biomass, Average DBH, Average Shrub Layer Height, Basal Area, Basal Area in Saplings, Basal Area of AGS, Basal Area of UGS, Board-Foot Value, Board-Foot Volume, Canopy Closure, Coarse Root Biomass, Coniferous Midstory, Coniferous Shrub Layer, Deciduous Midstory, Deciduous Shrub Layer, Ericaceous Shrub Layer, Fall Color Ground Layer, Fall Color Trees, Foliage Biomass, Ground Layer Percent Cover, Ground Layer with Fruits and Nuts, Ground Layer with Showy Flowers, Hard Mast, Height to Bottom of Canopy, High Slash, Litter Depth, Low Slash, Medial DBH, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Mixed Midstory, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume Net Pulpwood Volume, Net Sawlog Cubic Volume, Number of Big Trees Per Unit Area, Percent Basal Area Commercial, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Hardwoods, Percent Basal Area High Value, Percent Cover of Leaf Litter, Percent Cover Rock, Percent Open Plots, Percent Plots in Lg. Saw., Percent Plots in Pole, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Sm. Saw., Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Plots with Interesting Trees, Percent Regeneration Sprout, Pulpwood Cord Volume, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Quadratic Mean DBH, Relative Density, Relative Density of AGS, Relative Density of UGS, Sawlog Cubic Volume, Shrub Layer Percent Cover, Shrub Layer with Fall Color, Shrub Layer with Fruits and Nuts, Shrubs with Showy Flowers, Soft Mast, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Timber Value of the Stand, Total Biomass, Total Midstory, Trees with Fruits and Nuts, Trees with Showy Flowers.

Management Unit Report Descriptions

General Information

Management Unit Identification Data Report

Report Description: Displays the major identifying variables of the management unit.

About this report: These reports contain general variables which identify or characterize the management unit.

The variables fall under subheadings such as the following:

- **Identification and Location:** Name, Owner, State, County, Forest Name, District Name.
- **Measures:** Management Unit Area, Number of Stands, The Count of Forest Types on the Management Unit, The Count of Size Classes on the Management Unit, Percent of Area in Regeneration Size Class, Percent of Area in Sapling Size Class, Percent of Area in Pole Size Class, Percent of Area in Small Sawtimber Size Class, Percent of Area in Large Sawtimber Size Class, Number of Species in the Overstory Plots, Number of Species in the Understory Plots, Number of Species in the Transects, Number of Species in the Ground Plots.
- **Features:** Percent Openings, Land Type Association, Streams, Water, Roaded, Deer Impact.

Variables in this report are present only if a value exists for them in the NED database. If a particular variable is not present in your report, but is listed above, that usually indicates that no data is present for the variable.

Species List Report

Report Description: A list of species found on the management unit.

About this report: This report lists all the species which are found in the management unit. Species are listed in tabular form with their common name, Latin name and an indication of whether the species occurs in the overstory plots, understory plots, ground plots or transects of this management unit. The species are listed in the same order as they are in the Plant Species Information module.

Variable List Report

Report Description: A list of the management unit variables.

About this report: This report lists variables and values at the management unit level. The variables listed are selected by the user.

Variables in the table can include any combination of the following: County, Deer impact. District, Forest Name, Land Type Association, Management Unit Area, Name, Number of Stands, Owner, Roaded, State, Streams, Water.

Variables in this report are present only if a value exists for them in the NED database. If a particular variable is not present in your report, but is listed on the Enter/Edit Inventory module or the View Stand Snapshots module, that usually indicates that no data is present for the variable.

Stand Comparison Table Report

Report Description: Comparison table that shows the values of multiple variables across all stands in the management unit.

About this report: The stand comparison table displays stand level data for the management unit. All stands in the management unit are listed in rows. Data and variables included are selected by the user.

Variables in the table can include any combination of the following: Aboveground Biomass, Accessibility, Adjacent To Water, Aspect, Average DBH, Average Haul Distance, Average Shrub Layer Height, Basal Area, Basal Area in Saplings, Basal Area of AGS, Basal Area of UGS, Board-Foot Value, Board-Foot Volume, Building List, Canopy Closure, Caves, Coarse Root Biomass, Coarse Woody Debris, Coarse Woody Debris in Water, Compartment, Coniferous Midstory, Coniferous Shrub Layer, Contains a Riparian, Contains a Wetland, Dead Cavity Tree, Deciduous Midstory, Deciduous Shrub Layer, Ecological Land Type, Effective Age, Elevation, Ericaceous Shrub Layer, Exotics, Fall Color Ground Layer, Fall Color Trees, Feature To Screen, Feature To Show, Foliage Biomass, Forest Type, Ground Layer Percent Cover, Ground Layer with Fruits and Nuts, Ground Layer with Showy Flowers, Hard Mast, Height to Bottom of Canopy, High Perch, High Slash, Land Cover Type, Litter Depth, Live Cavity Tree, Loose Soils, Low Perch, Low Slash, Medial DBH, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Mixed Midstory, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume Net Pulpwood Volume, Net Sawlog Cubic Volume, Number of Big Trees Per Unit Area, Number of Plot Size Classes, Old Growth, Operability, Percent Area Riparian, Percent Area Wetland, Percent Basal Area Commercial, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Hardwoods, Percent Basal Area High Value, Percent Cover of Leaf Litter, Percent Cover Rock, Percent Open Plots, Percent Plots in Lg. Saw., Percent Plots in Pole, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Sm. Saw., Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Plots with Interesting Trees, Percent Regeneration Sprout, Permanent Ponds, Pulpwood Cord Volume, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Q Factor, Quadratic Mean DBH, Rare, Relative Density, Relative Density of AGS, Relative Density of UGS, Riparian, Roaded, Rock Crevices, Rock Piles, Sawlog Cubic Volume, Seeps, Shrub Layer Percent Cover, Shrub Layer with Fall Color, Shrub Layer with Fruits and Nuts, Shrubs with Showy Flowers, Site Index, Site Index Species, Size Class, Slope, Slope Shape, Soft Mast, Stand Area, Stand ID, Stems Per Unit Area, Stems Per Unit Area In Saplings, Stems Per Unit Area in Seedlings, Stream, Temporary Ponds, Timber Value of the Stand, Topographic Position, Total Biomass, Total Midstory, Trees with Fruits and Nuts, Trees with Showy Flowers, Unique Features, Wetland, Year of Maturity, Year of Origin.

Variables in this report are present only if a value exists for them in the NED database. If a particular variable is not present in your report, but is listed on the Enter/Edit Inventory module, that usually indicates that no data is present for the variable.

Stand Adjacency List Report

Report Description: A list of stands and their neighboring stands.

About this report: This report lists the stands in the management unit along with a list of stands that are adjacent to the stand.

User Preferences Report

Report Description: A list of the current settings for user preferences.

About this report: This report lists all default and user settings for the program. This includes information on screen and program behavior, and calculation parameters. It also includes the settings for the user-defined flags.

- The values that are set using the **Calculation settings** button in the Enter/Edit Inventory module include the following: Min DBH Softwood Saw Height, Min DBH Hardwood Saw Height, Min DBH Softwood Pulp Height, Min DBH Hardwood Pulp Height, Min Top Diameter for Bdft Calc, Min Top Diameter for Pulpwood Height, Overstory/Understory Threshold, Include Dead Trees in Timber Values, Include Understory in Calculations, Bdft Volume Equations to Use, Equation for Desirable Regen, Size Class Interval Used for Computing Q Factor, Smallest Sawlog to Estimate, Smallest Pulpwood Log to Estimate, Big Tree DBH Threshold.
- The values that are set using the **Pulpwood price settings** button in the Tree Species screen of the Plant Species Information module include the following: Pulpwood Price Units, Cubic Volume Per Cord, Tons Per Cord.
- The values that are set using the **Display settings** option under the **User settings** option under the Tools menu include the following: Units to Use, Plant Species Display, Color Data Source, Copy Headings to Clipboard.

Plant Species Values Report

Report Description: A list of the current plant species settings.

About this report: This report lists all plant and timber characteristics for each plant species in the current NED file. Variables are organized into the following tables:

- **Names:** Symbol, User Species Code, User Label, Category, Order Name, Family Name
- **Characteristics:** Growth Form, Shade Tolerance, Evergreen, Mast Type, Wetland Species, Ericaceous, Exotic, Rare, Showy Flowers, Fall Color, Showy Bark, Showy or Edible Fruit
- **Timber characteristics:** Cubic-Foot Correction Factor, Boardfoot Volume Correction Factor, Tons Per Cord, Timber Value Class, Girard Form Class, Hardwood or Softwood
- **Sawlog prices:** Price for Veneer, Price for Grade 1 Sawlogs, Price for Grade 2 Sawlogs, Price for Grade 3 Sawlogs, Price for Subfactory Sawlogs
- **Pulpwood prices:** Price for Whole Pulpwood, Price for Chipped Pulpwood, Price for Boltwood, Price for Firewood, Price for Local Use

Vegetation Tables

Table Wizard for Comparing Stands

Table Description: This is an on-screen table of your own design, providing for a variety of ways to analyze a single variable across your stands.

Columns: Select a variable to break down your data into categories such as Species, Timber Quality, Crown Class, etc.

Rows: Stand IDs (default) (you may elect to have stands in columns if desired).

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the point in time to view your management unit. When you specify a variable for the table, you have three choices for how to represent the variable (As a Per Area Value, As a Percent of the Stand, or As a Percent of the Management Unit).

Table diagram:

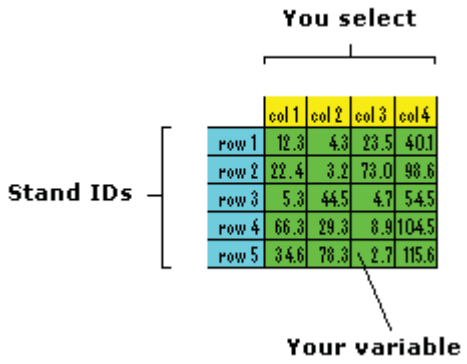


Table Wizard for Mgmt Unit Totals

Table Description: This is an on-screen table of your own design, providing for analysis of a variable at the management unit level for all of your stands combined. Possible variables only include those that can be totalled across stands. This is because the values in the table represent a summation over all stands in the management unit. The variable you select will be totalled for each stand individually by multiplying the per unit area value times stand area, resulting in a management unit total.

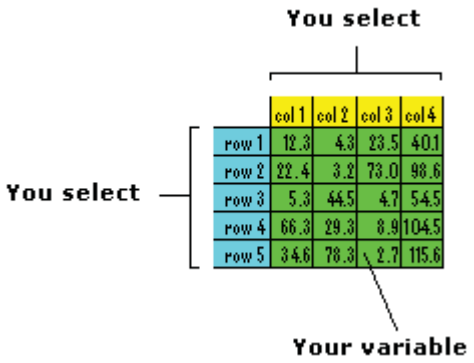
Columns: Select a variable to break down your data into categories such as Species, Timber Quality, Crown Class, etc.

Rows: Select a variable to break down your data into categories such as Species, Timber Quality, Crown Class, etc.

Option to compare multiple variables: Only one variable can be viewed at a time.

Notes: Select the point in time to view your management unit. Decide how you want to organize the table by selecting a variable for your columns, and another variable for your rows.

Table diagram:



Species x Stand Report

Report Description: A table of species by stands, with contents specified by the user.

About this report: This report displays a species by stand table. Stands will be in rows, the Species in columns. You will choose which variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table depend on the selections of plot types to include. The possible variables include the following:** Aboveground Biomass, Average DBH, Basal Area, Board-Foot Value, Coarse Root Biomass, Count, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- **Options for the row headings include the following:** Accessibility, Compartment, Ecological Land Type, Forest Type, Land Cover Type, Operability, Site Index Species, Size Class Slope Shape, Stand ID, Topographic Position.
- **Options for the column headings include the following:** Category, Common name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Species x Size Class Report

Report Description: A table of species by size classes, with contents specified by the user.

About this report: This report displays a species by size-class table. The size-classes will be in rows, the Species in columns. You will choose which variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table include the following:** Aboveground Biomass, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Pulpwood Value, Stem Bark Biomass, Stem Wood Biomass, Total Biomass.
- If understory observations are included, only the following will be available: Aboveground Biomass, Coarse Root Biomass, Foliage Biomass, and Total Biomass.
- **Options for the row headings include the following:** Midpoint of Range (diameter classes must be defined), Entire Range (diameter classes must be defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw).
- **Options for the column headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Size Class x Stand Report

Report Description: A table of size classes by stands, with contents specified by the user.

About this report: This report displays a size-class by stand table. The stands will be in rows, the size-classes in columns. You will choose which variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table depend on the plot types selected. Variable choices include the following:** Aboveground Biomass, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.

- **Options for the row headings include the following:** Accessibility, Compartment, Ecological Land Type, Forest Type, Land Cover Type, Operability, Site Index Species, Size Class Slope Shape, Stand ID, Topographic Position.
- **Options for the column headings include the following:** Midpoint of Range (diameter classes must be defined), Entire Range (diameter classes must be defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw).

Overstory Vegetation Summary Report

Report Description: A management unit level vegetation summary of the overstory.

About this report: The Overstory Vegetation Summary lists data for each stand within the management unit. There are two tables listing stand characteristics. There is also a forest type by size-class table displaying acreages for each forest type/size class combination.

- **Characteristics by Stands:** Stand Area, Forest Type, Size Class, Average DBH, Canopy Closure, Height to Bottom of Canopy, Basal Area, Relative Density, Deciduous Midstory, Coniferous Midstory, Mixed Midstory.
- **Characteristics across Stands:** Basal Area, Stems Per Unit Area, Medial DBH, Merchantable Medial DBH, Quadratic Mean DBH, Merchantable Quadratic Mean DBH, Canopy Closure, Deciduous Midstory, Coniferous Midstory, Mixed Midstory.

The means reported in these tables are weighted by stand area.

Understory Vegetation Summary Report

Report Description: A management unit level vegetation summary of the understory.

About this report: This report is a summary of understory vegetation characteristics. Two tables are displayed.

- **Understory Measurements:** Stems Per Unit Area in Saplings, Shrub Layer Percent Cover, Ground Layer Percent Cover, Coarse Woody Debris, Percent Cover of Leaf Litter, Percent Cover Rock.
- **Understory Features:** Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Plots with Interesting Trees, Ericaceous Shrub Layer, Coniferous Shrub Layer, Deciduous Shrub Layer, High Slash, Low Slash.

The means reported in these tables are weighted by stand area.

Ground Vegetation Summary Report

Report Description: A management unit level vegetation summary of the ground cover.

About this report: This report is a summary of ground vegetation characteristics.

- **Characteristics by Stands:** Stand Area, Loose Soils, Percent Cover of Leaf Litter, Litter Depth, Percent Cover Rock, Rock Piles, Rock Crevices, Ground Layer Percent Cover, Fall Color Ground Layer, Ground Layer with Fruits and Nuts, Ground Layer with Showy Flowers.

Biomass Tables Report

Report Description: A management unit level summary of the biomass.

About this report: This report has tables showing biomass for each stand. There are separate tables for live and dead biomass, and a table for combined live and dead biomass. Biomass is calculated using the methods of Jenkins et al. (2003).

Table variables include the following: Foliage Biomass, Stem Wood Biomass, Stem Bark Biomass, Aboveground Biomass, Coarse Root Biomass, Total Biomass.

Carbon Storage

Report Description: A summary of the total amount of carbon in standing live and dead trees on the management unit.

About this report: This report has tables showing carbon storage for each stand. There are separate tables for live and dead trees, and a table for combined live and dead trees. The amount of carbon is computed as 50% of the biomass, which is calculated using the methods of Jenkins et al. (2003).

Table variables include the following: Foliage Carbon, Stem Wood Carbon, Stem Bark Carbon, Aboveground Carbon, Coarse Root Carbon, Total Carbon.

Resource Narratives

Ecology Narrative Report

Report Description: A narrative on the ecology of the management unit.

About this report: This report will give a general indication of the quality of the management unit in regard to ecology resources. There are several tables in the report with the following values:

- **Physiography:** Stand Area, Topographic Position, Slope, Aspect, Slope Shape, Elevation.
- **Stand structure:** Land Cover Type, Forest Type, Size Class, Stems Per Unit Area, Basal Area, Merchantable Medial DBH, Average DBH.
- **Wetland status:** Wetland, Riparian, Contains a Wetland, Contains a Riparian, Percent Area Wetland, Percent Area Riparian, Permanent Ponds, Temporary Ponds, Seeps, Stream, Adjacent to Water.
- **Overstory vegetation:** Species Richness (Count), Dominant Species.
- **Understory vegetation:** Shrub Cover, Average Shrub Height, Species Richness (Count), Most Abundant Species.
- **Ground cover:** Percent Ground Cover, Litter Cover, Litter Depth, Loose Soil, Rock Cover, Species Richness (Count), Most Abundant Species.
- **Exotic (nonnative species):** List of exotic species found on the management unit.
- **Biomass:** Aboveground Biomass, Root Biomass, Total Biomass.

Timber Narrative Report

Report Description: A narrative on timber in the management unit.

About this report: This report will give a general indication of the quality of the management unit in regard to timber resources. Information reported on includes the distribution of size classes, stocking, basal area and relative density of each species in management unit, timber volume by species, timber value, and pest considerations.

- **Stocking:** Basal Area, Relative Density
- **Timber volume:** Net Board-Foot Volume, Net Pulpwood Volume, Net Sawlog Cubic Volume, Net Merchantable Cubic Volume
- **Timber value:** Board-Foot Value, Pulpwood Value, Timber Value of the Stand. If specific product codes were entered during inventory, values are determined using those products and prices, otherwise a default product mix is used in calculations (Ernst and Marquis 1979, Myers et. al. 1986).
- **Regeneration issues:** Deer Impact.

Visual Quality Narrative Report

Report Description: A narrative on the management unit's visual quality.

About this report: This report will give a general indication of the quality of the management unit in regard to visual quality resources. The report includes information on management unit size, forest types, relative density and average tree sizes. Data are listed for each stand pertaining to area, land cover, and forest type.

General information is discussed such as canopy heights, canopy closure, and the density of deciduous, coniferous and mixed vegetation in the midstory. Shrub and midstory layers are assessed in terms of screening ability of vegetation. Average canopy closure, canopy height, midstory cover, shrub cover and ground cover are listed by forest type.

Visual features are listed such as showy fall colors and proportions of contrasting foliage in trees and shrubs. The following data are listed by stand: Stand Area, Percent Conifers, Number of Flowering Trees, Tree Fall Color Percent, Percent Basal Area of Fruit and Nut Trees, Percent Flowering Shrubs, Percent Shrub Fall Color, Percent Cover of Fruit and Nut Shrubs, Percent Flowering Ground Cover, Percent Ground Fall Color, and Percent Cover of Fruit and Nut Ground-Cover Species.

Variables used in report include the following:

- Stand Area, Average DBH, Number of Big Trees Per Unit Area.
- Stand Area, Forest Type, Canopy Closure, Height to Bottom of Canopy, Total Midstory, Shrub Layer Percent Cover, Ground Layer Percent Cover.
- **Fall color:** Stand Area, Fall Color Trees, Shrub Layer with Fall Color, Fall Color Ground Layer.
- **Showy flowers and fruit:** Stand Area, Trees with Showy Flowers, Trees with Fruits and Nuts, Shrubs with Showy Flowers, Shrub Layer with Fruits and Nuts, Ground Layer with Showy Flowers, Ground Layer with Fruits and Nuts.
- **Contrasting foliage:** Stand Area, Deciduous Midstory, Coniferous Midstory, Mixed Midstory.

Water Narrative Report

Report Description: A narrative on the water resources in the management unit.

About this report: This report will give a general indication of the quality of the management unit in regard to water resources. Information in the report includes streams present on the management unit.

Wildlife Narrative Report

Report Description: A narrative on wildlife in the management unit.

About this report: This report will give a general indication of the quality of the management unit in regard to wildlife habitat resources. Features in the report include presence of streams, openings, and roads. The report also includes a deer impact rating, a discussion of the structure within the management unit in terms of stand size classes, and the impact those ratings may have on wildlife species present.

The following variables are used to evaluate the individual species goals by stand:

- Forest Type, Size Class, Coarse Woody Debris.
- Ground Layer Percent Cover, Shrub Layer Percent Cover, Coniferous Shrub Layer, Deciduous Shrub Layer, Ericaceous Shrub Layer, Deciduous Midstory, Coniferous Midstory, Mixed Midstory, Canopy Closure, Percent Cover Rock, Percent Cover of Leaf Litter.
- Temporary Ponds, Permanent Ponds, Seeps, Stream, Loose Soils, Rock Piles, Rock Crevices, Caves, Dead Cavity Tree, Live Cavity Tree, Soft Mast, Hard Mast, High Perch, Low Perch.

Goal Analysis

Selected Goal List Report

Report Description: A list of the current goals selected by the user in each of the goal sets associated with the current NED-2 file.

About this report: This report lists the goals currently selected by the user for the management unit and individual stands.

Spatial Reports

Forest Type Patch Analysis Report

Report Description: Overstory patch analysis (forest type patches).

About this report: The forest patch report focuses on landscape ecology and the spatial arrangement of habitats. Patches are defined as contiguous areas of similar vegetation characteristics, surrounded by areas having dissimilar characteristics. Patches may be delineated using several variables such as forest type, size class, or canopy closure.

Tables are provided reporting on the patchiness of the management unit. Each patch is described using variables such as Forest Type, Number of Patches Per Forest Type, Percent of Management Unit for Each Patch, Mean Area of the Patches, etc. A narrative is also supplied, giving an indication as to how the patchiness of the management unit relates to the types of habitat available.

All patch analyses are dependent on adjacencies being assigned to each stand, which can be performed manually or through the geographic information system (GIS) tool if you have a shape file for your stands.

Size Class Patch Analysis Report

Report Description: Overstory patch analysis (size class patches).

About this report: The forest patch report focuses on landscape ecology and the spatial arrangement of habitats. Patches are defined as contiguous areas of similar vegetation characteristics, surrounded by areas having dissimilar characteristics. Patches may be delineated using several variables such as Forest Type, Size Class, or Canopy Closure.

Tables are provided reporting on the patchiness of the management unit. Each patch is described using variables such as Size Class, Number of Patches Per Size Class, Percent of Management Unit for Each Patch, Mean Area of the Patches, etc. A narrative is also supplied, giving an indication as to how the patchiness of the management unit relates to the types of habitat available.

All patch analyses are dependent on adjacencies being assigned to each stand, which can be performed manually or through the GIS tool if you have a shape file for your stands.

Forest Type and Size Class Patch Analysis Report

Report Description: Overstory patch analysis (forest type and size class patches).

About this report: The forest patch report focuses on landscape ecology and the spatial arrangement of habitats. Patches are defined as contiguous areas of similar vegetation characteristics, surrounded by areas having dissimilar characteristics. Patches may be delineated using several variables such as Forest Type, Size Class, or Canopy Closure.

Tables are provided reporting on the patchiness of the management unit. Each patch is described using variables such as Forest Type in a Particular Size Class, Number of Patches Per Forest Type in Each Size Class, Percent of Management Unit for Each Patch, Mean Area of the Patches, etc. A narrative is also supplied, giving an indication as to how the patchiness of the management unit relates to the types of habitat available.

All patch analyses are dependent on adjacencies being assigned to each stand, which can be performed manually or through the GIS tool if you have a shape file for your stands.

Canopy Closure Patch Analysis Report

Report Description: Overstory patch analysis (canopy closure).

About this report: The forest patch report focuses on landscape ecology and the spatial arrangement of habitats. Patches are defined as contiguous areas of similar vegetation characteristics, surrounded by areas having dissimilar characteristics. Patches may be delineated using several variables such as Forest Type, Size Class, or Canopy Closure.

Tables are provided reporting on the patchiness of the management unit. Each patch is described using variables such as Canopy Closure, Number of Patches Per Category, Percent of Management Unit for Each Patch, Mean Area of the Patches, etc. A narrative is also supplied, giving an indication as to how the patchiness of the management unit relates to the types of habitat available.

All patch analyses are dependent on adjacencies being assigned to each stand, which can be performed manually or through the GIS tool if you have a shape file for your stands.

Stand Report Descriptions

Overstory Statistics Report

Report Description: Statistical values for overstory inventory data.

About this report: The report will display a table summarizing the inventory process including the following variables: Date Inventory was Taken, Who Took Inventory, Overstory Inventory Type, and Overstory Prism BAF.

The variables to be analyzed must be selected by the user. The report will include values for each variable at the plot level, along with summary statistics such as the minimum value, maximum value, mean, variance, standard deviation, and standard error. Variables available for analysis include the following: Stems Per Unit Area, Basal Area, Relative Density, Board-Foot Volume, Net Board-Foot Volume, Merchantable Cubic Volume, Net Merchantable Cubic Volume, Pulpwood Volume, and Net Pulpwood Volume.

You may choose any combination of these variables. If confidence levels are selected, additional tables are generated for each confidence interval. The table includes mean lower and upper limit and the estimated number of plots to be within 15% and within 10% of the true mean value at the selected level of confidence.

General Information

Stand Identification Data Report

Report Description: A display of the major stand identification data.

About this report: These reports contain general variables which identify or characterize the stand. These variables fall under subheadings such as the following:

- **Identification and Location**: Stand ID Date Inventory was Taken, Compartment.
- **Site Characteristics**: Elevation, Aspect, Slope, Slope Shape, Topographic Position, Ecological Land Type.
- **Measures**: Stand Area, Canopy Closure, Stems Per Unit Area, Number of Plot Size Classes, Basal Area, Relative Density, Shrub Layer Percent Cover, Ground Layer Percent Cover.
- **Stand Characteristics**: Land Cover Type, Forest Type, Site Index Species, Site Index, Size Class, Year of Origin.
- **Features**: Percent Area Riparian, Percent Area Wetland, Stream, Percent Open Plots, Feature to Show, Feature to Screen, Contains a Wetland, Contains a Riparian, Old Growth, Rare, Unique Features.

Species List Report

Report Description: A list of species recorded in the stand inventory data.

About this report: This report lists all the species which are found in the stand. Species are listed in tabular form with their common name, Latin name, and an indication of whether the species occurs in the overstory plots, understory plots, ground plots, or transects of the stand. The species are listed in the same order as they are in the Plant Species Information module. For additional information, refer to the topic on Sorting Species in the Plant Species Short-List.

Stand Variable List Report

Report Description: A list of selected stand variables and values.

About this report: This report lists variables and values at the stand level. The variables listed are selected by the user. **Note:** There is a limited number of variables, approximately 15, that can be displayed at one time in this report. NED-2 will inform you if you have exceeded this limit, and allow you to change your selections.

Variables in the table can include any combination of the following: Aboveground Biomass, Accessibility, Adjacent Stands, Adjacent to Water, Aspect, Average DBH, Average Haul Distance, Average Shrub Layer Height, Basal Area, Basal Area in Saplings, Basal Area of AGS, Basal Area of UGS, Board-Foot Value, Board-Foot Volume, Building List, Canopy Closure, Caves, Coarse Root Biomass, Coarse Woody Debris, Coarse Woody Debris in Water, Compartment, Coniferous Midstory, Coniferous Shrub Layer, Contains a Riparian, Contains a Wetland, Dead Cavity Tree, Deciduous Midstory, Deciduous Shrub Layer, Ecological Land Type, Effective Age, Elevation, Ericaceous Shrub Layer, Exotics, Fall Color Ground Layer, Fall Color Trees, Feature to Screen, Feature to Show, Foliage Biomass, Forest Type, Ground Layer Percent Cover, Ground Layer with Fruits and Nuts, Ground Layer with Showy Flowers, Hard Mast, Height to Bottom of Canopy, High Perch, High Slash, Land Cover Type, Litter Depth, Live Cavity Tree, Loose Soils, Low Perch, Low Slash, Medial DBH, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Mixed Midstory, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume. Net Pulpwood Volume, Net Sawlog Cubic Volume, Number of Big Trees Per Unit

Area, Number of Plot Size Classes, Old Growth, Operability, Percent Area Riparian, Percent Area Wetland, Percent Basal Area Commercial, Percent Basal Area Conifer, Percent Basal Area Evergreen, Percent Basal Area Hardwoods, Percent Basal Area High Value, Percent Cover of Leaf Litter, Percent Cover Rock, Percent Open Plots, Percent Plots in Lg. Saw., Percent Plots in Pole, Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Sm. Saw., Percent Plots Stocked with Commercial Regen., Percent Plots Stocked with High Value Regen., Percent Plots with Interesting Trees, Percent Regeneration Sprout, Permanent Ponds, Pulpwood Cord Volume, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Q Factor, Quadratic Mean DBH, Rare, Relative Density, Relative Density of AGS, Relative Density of UGS, Riparian, Roaded, Rock Crevices, Rock Piles, Sawlog Cubic Volume, Seeps, Shrub Layer Percent Cover, Shrub Layer with Fall Color, Shrub Layer with Fruits and Nuts, Shrubs with Showy Flowers, Site Index, Site Index Species, Size Class, Slope, Slope Shape, Soft Mast, Stand Area, Stand ID, Stems Per Unit Area, Stems Per Unit Area in Saplings, Stems Per Unit Area in Seedlings, Stream, Temporary Ponds, Timber Value of the Stand, Topographic Position, Total Biomass, Total Midstory, Trees with Fruits and Nuts, Trees with Showy Flowers, Unique Features, Wetland, Year of Maturity, Year of Origin.

Overstory Plot Variable List Report

Report Description: A list of selected overstory plot variables and values.

About this report: This report lists variables and values at the overstory plot level. The variables listed are selected by the user. **Note:** There is a limited number of variables, approximately 15, that can be displayed at one time in this report. NED-2 will inform you if you have exceeded this limit, and allow you to change your selections.

Variables in the table can include any combination of the following: Aboveground Biomass, Board-Foot Value, Board-Foot Volume, Canopy Closure, Coarse Root Biomass, Dead Cavity Tree, Dollar Value, Foliage Biomass, Hard Mast, Live Cavity Tree, Map X-Coordinate, Map Y-Coordinate, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Midstory Closure, Midstory Type, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume. Net Pulpwood Volume, Net Sawlog Cubic Volume, Plot ID, Plot Size Class, Pulpwood Cord Volume, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Riparian Plot, Sawlog Cubic Volume, Soft Mast, Total Biomass, User Comments.

Overstory Observation (Tree) List Report

Report Description: A list of selected overstory observation variables and values.

About this report: This report lists variables and values at the overstory observation (tree) level. The variables listed are selected by the user. **Note:** There is a limited number of variables, approximately 15, that can be displayed at one time in this report. NED-2 will inform you if you have exceeded this limit, and allow you to change your selections.

Variables in the table can include any combination of the following: Aboveground Biomass, Basal Area, Board-Foot Value, Board-Foot Volume, Cavity, Coarse Root Biomass, Crown Class, Crown Condition, Crown Ratio, DBH, Dollar Value, Foliage Biomass, Height Class, Height

of Plant, Living, Maximum Crown Width, Merchantable Cord Volume, Merchantable Cubic Volume, Merchantable Height, Merchantable Stem Bark Biomass, Merchantable Stem Wood Biomass, Merchantable Ton Volume, Most Valuable Product, Net Board-Foot Volume, Net Merchantable Cord Volume, Net Merchantable Cubic Volume, Net Merchantable Ton Volume, Net Pulpwood Cord Volume, Net Pulpwood Ton Volume. Net Pulpwood Volume, Net Sawlog Cubic Volume, Pulpwood Cord Volume, Pulpwood Defect, Pulpwood Height, Pulpwood Ton Volume, Pulpwood Value, Pulpwood Volume, Relative Density, Sawlog Cubic Volume, Sawlog Defect, Sawlog Height, Species, Stem Count, Stems Per Unit Area, Timber Quality, Total Biomass, Tree ID, User Comments, Custom Variable 1, Custom Variable 2, Custom Variable 3, Custom Variable 4, Custom Variable 5, Custom Variable 6, Visually Interesting.

Overstory Tree Log List Report

Report Description: A list of selected overstory tree log variables and values.

About this report: This report lists variables and values at the overstory observation (tree) level, and lists the individual logs for the observations. The variables listed are selected by the user. **Note:** There is a limited number of variables, approximately 15, that can be displayed at one time in this report. NED-2 will inform you if you have exceeded this limit, and allow you to change your selections.

Overstory observation (tree) variables in the table can include any combination of the following:
Aboveground Biomass, Basal Area, Board-Foot Value, Branch Biomass, Cavity, Coarse Root Biomass, Crown Class, Crown Condition, Crown Ratio, DBH, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Height Class, Height of Plant, Living, Maximum Crown Width, Merchantable Height, Most Valuable Product, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Pulpwood Defect, Pulpwood Height, Pulpwood Value, Relative Density, Sawlog Defect, Sawlog Height, Species, Stem Bark Biomass, Stem Count, Stem Wood Biomass, Stems Per Unit Area, Timber Quality, Total Biomass, Tree ID, User Comments, Custom Variable 1, Custom Variable 2, Custom Variable 3, Custom Variable 4, Custom Variable 5, Custom Variable 6, Visually Interesting.

Tree log variables in the table can include any combination of the following: Dollar Value, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Tons, Length, Log ID, Log Product, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Tons.

Understory Plot Variable List Report

Report Description: A list of selected understory plot variables and values.

About this report: This report lists variables and values at the understory plot level. The variables listed are selected by the user. **Note:** There is a limited number of variables, approximately 15, that can be displayed at one time in this report. NED-2 will inform you if you have exceeded this limit, and allow you to change your selections.

Variables in the table can include any combination of the following: Aboveground Biomass, Average Shrub Layer Height, Branch Biomass, Coarse Root Biomass, Coniferous Shrub Layer, Cover of Fall Color in Shrub Layer, Cover of Foliage in Shrub Layer, Cover of Fruiting Plants in Shrub Layer, Deciduous Shrub Layer, Ericaceous Shrub Layer, Flowery Shrub Layer, Foliage Biomass, Hard Mast, Inventory Plot Count, Map X-Coordinate, Map Y-Coordinate, Percent Regen Sprout, Plot ID, Potential Residual Tree, Riparian Plot, Soft Mast, Stem Bark Biomass, Stem Wood Biomass, Stocked with Commercial Regen., Stocked with High Value Regen., Total Biomass, User Comments, Wetland Vegetation.

Understory Observation Variable List Report

Report Description: A list of selected understory observation variables and values.

About this report: This report lists variables and values at the understory observation level. The variables listed are selected by the user. **Note:** There is a limited number of variables, approximately 15, that can be displayed at one time in this report. NED-2 will inform you if you have exceeded this limit, and allow you to change your selections.

Variables in the table can include any combination of the following: Aboveground Biomass, Basal Area, Branch Biomass, Coarse Root Biomass, Crown Ratio, DBH, Foliage Biomass, Height Class, Height Layer, Height of Plant, Living, Maximum Crown Width, Observation ID, Origin of Plant, Percent Cover, Relative Density, Species, Stem Bark Biomass, Stem Count, Stem Wood Biomass, Stems Per Unit Area, Total Biomass, Custom Variable 1, Custom Variable 2, Custom Variable 3, Custom Variable 4, Custom Variable 5, Custom Variable 6.

Ground Plot Variable List Report

Report Description: A list of selected ground plot variables and values.

About this report: This report lists variables and values at the ground plot level. The variables listed are selected by the user. **Note:** There is a limited number of variables, approximately 15, that can be displayed at one time in this report. NED-2 will inform you if you have exceeded this limit, and allow you to change your selections.

Variables in the table can include any combination of the following: Average Shrub Layer Height, Coniferous Shrub Layer, Cover of Fall Color in Ground Layer, Cover of Fall Color in Shrub Layer, Cover of Foliage in Ground Layer, Cover of Foliage in Shrub Layer, Cover of Fruiting Plants in Ground Layer, Cover of Fruiting Plants in Shrub Layer, Deciduous Shrub Layer, Ericaceous Shrub Layer, Flowery Ground Layer, Flowery Shrub Layer, Hard Mast, Inventory Plot Count, Litter Depth, Map X-Coordinate, Map Y-Coordinate, Percent Grass and Sedge, Percent Inhibiting Fern, Percent Litter, Percent Moss, Percent Other Fern, Percent Regen Sprout, Percent Rock, Plot ID, Riparian Plot, Rockiness Barrier to Regen, Soft Mast, Stocked with Commercial Regen., Stocked with High Value Regen., User Comments, Wetland Vegetation, Wetness Barrier to Regen.

Ground Observation Variable List Report

Report Description: A list of selected ground observation variables and values.

About this report: This report lists variables and values at the ground observation level. The variables listed are selected by the user.

Variables in the table can include any combination of the following: Height Class, Height Layer, Height of Plant, Observation ID, Origin of Plant, Percent Cover, Species, Stem Count, Stems Per Unit Area, Custom Variable 1, Custom Variable 2, Custom Variable 3, Custom Variable 4, Custom Variable 5, Custom Variable 6.

Transect Variable List Report

Report Description: A list of selected transect variables and values.

About this report: This report lists variables and values at the transect level. The variables listed are selected by the user.

Variables in the table can include any combination of the following: High Slash, Interesting Tree, Inventory Transect Count, Low Slash, Transect ID, Transect Length, User Comments, Volume.

Transect Observation Variable List Report

Report Description: A list of selected between plot observation variables and values.

About this report: This report lists variables and values at the transect observation level. The variables listed are selected by the user.

Variables in the table can include any combination of the following: Bark, Condition, Count, Diameter, Species, Transect Observation ID.

Vegetation Tables

Vegetation Table Wizard

Report Description: Vegetation table wizard.

Description: This report uses the general table wizard to allow you to create a custom stand table of your own design. You can also use it to build any of the standard tables for single stands. See the topic “How to Run Vegetation Table Wizards” on page 145 of athe NED-2 User’s Guide (Twery et al. 2011) for more detail.

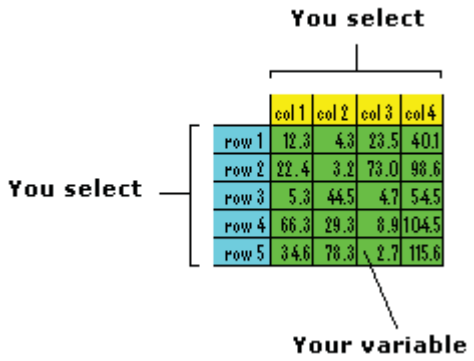
Columns: You select.

Rows: You select.

Options: One variable at a time.

Instructions: Select the stand of your choice at a valid point in time along the planning cycle. Decide how you want to organize the table by selecting a variable for your columns, and another variable for your rows.

Table diagram:



Species x Diameter Report

Report Description: A table of species by diameter, with contents specified by the user.

About this report: This report displays a species by diameter table. Diameters will be in rows, the species in columns. You will choose which variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table include the following:** Aboveground Biomass, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- The list of variables will change depending on which plot data is included (i.e., Overstory, Understory, or both). If more than one plot type is chosen, the only variables available will be those that exist in all selected plot types.
- **Options for the row headings include the following:** Midpoint of Range (diameter classes must be defined), Entire Range (diameter classes must be defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw).
- **Options for the column headings include:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.

Product x Species Report

Report Description: A table of products by species, with contents specified by the user.

About this report: This report displays a product by species table. Products will be in rows, the species in columns. You will choose which variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table include the following:** Aboveground Biomass, Average Dbh, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- **Options for the row headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.
- **The column headings:** These will be valid values of the Log product which are as follows: Veneer, Sawlog, Grade 1 Sawlog, Grade 2 Sawlog, Grade 3 Sawlog, Subfactory Sawlog, Pulpwood, Chipped Pulpwood, Whole Pulpwood, Boltwood, Firewood, and Local Use. If you select Board-Foot Volume, the column headings will only contain sawtimber products.

Custom Variable x Species Report

Report Description: A table of custom variables by species, with contents specified by the user.

About this report: This report displays a custom variable by species table. Values of custom variables will be in rows, the species in columns. You will choose which custom variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table include the following:** Aboveground Biomass, Average DBH, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- The list of variables will change depending on which plot data is included (i.e., Overstory, Understory, or Ground). If more than one plot type is chosen, the only variables available will be those that exist in all selected plot types.

- **Options for the row headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.
- **Options for the column headings include the following:** You must choose one of the six custom variables. The custom variables can be re-named using the **Custom variable definitions** button in the Enter/Edit Inventory module.

Product x Diameter Report

Report Description: A table of products by diameters, with contents specified by the user.

About this report: This report displays a product by diameter table. Diameters will be in rows, the products in columns. You will choose which variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table include the following:** Aboveground Biomass, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Pulpwood Value, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- **Options for the row headings include the following:** Midpoint of Range (diameter classes must be defined), Entire Range (diameter classes must be defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, and Lg Saw).
- **The column headings:** These will be valid values of the Log product which are as follows: Veneer, Sawlog, Grade 1 Sawlog, Grade 2 Sawlog, Grade 3 Sawlog, Subfactory Sawlog, Pulpwood, Chipped Pulpwood, Whole Pulpwood, Boltwood, Firewood, and Local Use. If you select Board-Foot Volume, the column headings will only contain sawtimber products.

Custom Variable x Diameter Report

Report Description: A table of custom variables by diameters, with contents specified by the user.

About this report: This report displays a custom variable by diameter table. Diameters will be in rows, the values of custom variables in columns. You will choose which custom variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table include the following:** Aboveground Biomass, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Gross Tons Sawlogs, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord

Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.

- **Options for the row headings include the following:** Midpoint of Range (diameter classes must be defined), Entire Range (diameter classes must be defined), Size Class (Seedlings, Saps, Poles, Sm Saw, Med Saw, aAnd Lg Saw).
- **Options for the column headings include the following:** You must choose one of the six custom variables. The custom variables can be re-named using the **Custom variable definitions** button in the Enter/Edit Inventory module.

Height Classes x Species Report

Report Description: A table of height classes by species, with contents specified by the user.

About this report: This report displays a height-class by species table. Height-classes will be in rows, the species in columns. You will choose which variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table include the following:** Aboveground Biomass, Average Dbh, Basal Area, Board-Foot Value, Coarse Root Biomass, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass.
- The list of variables will change depending on which plot data is included (i.e., Overstory, Understory, or Ground). If more than one plot type is chosen, the only variables available will be those that exist in all selected plot types.
- **Options for the row headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.
- **The column headings:** These will be valid values of the Height class which are defined by the user in the Inventory settings for the stand.

Plot Cluster x Species Report

Report Description: A table of plot-clusters by species, with contents specified by the user.

About this report: This report displays a plot cluster by species table and is useful for examining variability within a stand. Species will be in rows, the plot clusters in columns. You will choose which variable to report on as well as which observations to include. You may also specify whether to display the results in percentages or by totals.

- **Options for the contents of the table depend on the selections of plot types to include. The possible variables include the following:** Aboveground Biomass, Average DBH, Basal Area, Board-Foot Value, Coarse Root Biomass, Count, Dollar Value, Foliage Biomass, Gross Board-Foot Volume, Gross Cord Volume, Gross Cubic Volume, Gross Pulpwood Cord Volume, Gross Pulpwood Cubic Volume, Gross Sawlog Cord Volume, Gross Sawlog Cord Volume, Gross Sawlog Cubic Volume, Gross Tons, Gross Tons Pulpwood, Medial DBH, Merchantable Medial DBH, Merchantable Quadratic Mean DBH, Net Board-Foot Volume, Net Cord Volume, Net Cubic Volume, Net Pulpwood Cord Volume, Net Pulpwood Volume, Net Sawlog Cord Volume, Net Sawlog Cubic Volume, Net Tons, Net Tons Pulpwood, Net Tons Sawlogs, Percent Cover, Pulpwood Value, Quadratic Mean DBH, Relative Density, Stem Bark Biomass, Stem Wood Biomass, Stems Per Unit Area, Total Biomass, Volume.
- **Options for the row headings include the following:** Category, Common Name, Ericaceous, Evergreen, Exotic, Fall Color, Family Name, Growth Form, Hardwood or Softwood, Latin Name, Mast Type, Order Name, Rare, Shade Tolerance, Showy Bark, Showy Flowers, Showy or Edible Fruit, Symbol, Timber Value Class, User Label, User Species Code, Wetland Species.
- **The column headings:** These will be the plot-cluster IDs.

Timber Tables Report

Report Description: A summary of the timber-oriented values of a stand, comprised of a series of tables.

About this report: This report gives a summary of the selected stand's timber data, and can be based on overstory or understory data, or both combined. A column is included for each individual tree species as well as one for all species combined. Data in the summary includes the following:

- **Composition**: Basal Area and Stems Per Unit Area.
- **Diameters**: Medial DBH, Merchantable Medial DBH, Quadratic Mean DBH, Merchantable Quadratic Mean DBH, Average DBH.
- **Structure**: Q factor. **Note:** Species with q-factor values of zero (0.0) result in cases where only one stem was recorded in all plots.
- **Relative density**: Relative Density.
- **Volumes**: Cubic Volume, Net Cubic Volume, Net Pulpwood Volume, Board-Foot Volume, Net Board-Foot Volume.
- **Values**: Pulpwood Value, Board-Foot Value, Dollar Value.
- **Biomass**: Coarse Root Biomass, Stem Wood Biomass, Stem Bark Biomass, Foliage Biomass, Aboveground Biomass, Total Biomass.

Dead/Down Summary Report

Report Description: A summary of dead/down observations on the stand.

About this report: This report provides a summary of the transect observations. The following two sections are in the report:

- **Snags:** The report displays a table containing the snags. The snags are identified using the overstory observations (trees) where Living is FALSE. The table contains Stems Per Unit Area values and is broken into 6-inch size classes.
- **Dead/down woody material:** This section reports the coarse woody debris for the stand. If the diameter and condition of the observations are recorded there will be a table reporting the observation count grouped into 6-inch size classes. If the species and diameter of the observations are recorded there will be a table reporting the observation count for each species grouped into 6-inch size classes.

Ground Vegetation Summary Report

Report Description: A stand-level vegetation summary of the ground cover.

About this report: This report gives a summary of the selected stand's ground data. Data in the summary includes plot information on the following characteristics:

- **Ground Measurements**: Shrub Layer Percent Cover, Percent Ground Cover, Percent Rock, Percent Litter, Volume, Percent Moss, Percent Grass and Sedge, Percent Inhibiting Fern, Percent Other Fern, Percent Regen Sprout.
- **Ground Feature Observations**: Stocked with High Value Regen., Stocked with Commercial Regen., Potential Residual Tree, Wetness Barrier to Regen, Rockiness Barrier to Regen., Deciduous Shrub, Coniferous Shrub v Ericaceous Shrub, Wetland Vegetation, Riparian Plot, Interesting Tree, High Slash, Low Slash.

Overstory Species Composition and Diversity Report

Report Description: An analysis of the occurrence and abundance of species in the overstory.

About this report: This report provides quantitative and qualitative descriptions of the overstory plot species data. An option is available for the choice of stems per unit area or basal area for the variable used in the Renkonen's Index of Similarity Percentage (Renkonen 1938) and Morisita-Horn Similarity Index calculations (see Magurran 1988).

Understory Species Composition and Diversity Report

Report Description: An analysis of the occurrence and abundance of species in the understory.

About this report: This report provides quantitative and qualitative descriptions of the understory plot species data. Dominance can be measured using either the percent cover or basal area.

The report can produce a table displaying species occurrence by height class. Analysis variables include Density, Relative Density, Frequency, Relative Frequency, Dominance, Relative Dominance, and Importance Value.

An option is available for the choice of percent cover, stems per unit area, or basal area for the variable used in the Renkonen's Index of Similarity Percentage and Morisita-Horn Similarity Index calculations.

Ground Species Composition and Diversity Report

Report Description: An analysis of the occurrence and abundance of species in the ground cover.

About this report: This report provides quantitative and qualitative descriptions of the ground plot species data. The report can produce a table displaying species occurrence by height class. Analysis variables include Density, Relative Density, Frequency, Relative Frequency, Dominance, Relative Dominance, and Importance Value.

An option is available for the choice of percent cover or stems per unit area for the variable used in the Renkonen's Index of Similarity Percentage and Morisita-Horn Similarity Index calculations.

Biomass Tables Report

Report Description: A stand-level biomass summary of the stand.

About this report: This report has tables showing biomass for the stand. There are separate tables for overstory and understory biomass, and a table for combined overstory and understory biomass. Biomass is calculated using the methods of Jenkins et al. (2003).

Table variables include the following: Foliage Biomass, Stem Wood Biomass, Stem Bark Biomass, Aboveground Biomass, Coarse Root Biomass, and Total Biomass.

Carbon Storage

Report Description: A stand-level summary of the total amount of carbon in standing live and dead trees.

About this report: This report has tables showing carbon storage for a stand. There are separate tables for live and dead trees, and a table for combined live and dead trees. The amount of carbon is computed as 50% of the biomass, which is calculated using the methods of Jenkins et al. (2003).

Table variables include the following: Foliage Carbon, Stem Wood Carbon, Stem Bark Carbon, Aboveground Carbon, Coarse Root Carbon, and Total Carbon.

Resource Narratives

Ecology Narrative Report

Report Description: A narrative on the ecology of the stand.

About this report: This report provides a general indication of the ecological character of a stand. Starting with physiography and stand structure, the report lists the species composition of the overstory, understory, and ground layers. Exotic species are listed if present; wetland features are described; down woody debris and biomass are summarized. The report references the following variables:

- **Physiography and general site information:** Stand Area, Elevation, Aspect, Slope, Slope Shape, Topographic Position, Ecological Land Type, Land Cover Type, Forest Type, Site Index Species, Site Index, Size Class, Year of Origin.
- **Stand structure:** Percent Plots in Regeneration, Percent Plots in Sapling, Percent Plots in Pole, Percent Plots in Sm. Saw., Percent Plots in Lg. Saw., Land Cover Type, Forest Type, Stems Per Unit Area, Basal Area, Relative Density, Quadratic Mean DBH.
- **Wetland status:** Wetland, Contains a Wetland, Riparian, Contains a Riparian, Percent Area Wetland, Percent Area Riparian, Temporary Ponds, Permanent Ponds, Seeps, Stream, Adjacent to Water.
- **Overstory vegetation:** Basal Area and Stems Per Unit Area.
- **Shrub Layer Characteristics:** Shrub Layer Percent Cover and Average Shrub Layer Height.
- **Ground Layer Characteristics:** Litter Depth.
- **Ground Cover:** Percent Ground Cover, Rockiness Barrier to Regen., Wetness Barrier to Regen., Percent Litter, Percent Moss, Percent Rock, Percent Grass and Sedge, Percent Inhibiting Fern, Percent Other Fern.
- **Exotic (non-native species):** Exotics.
- **Coarse Woody Debris:** Volume, High Slash, Low Slash.
- **Biomass:** Aboveground Biomass, Coarse Root Biomass, Total Biomass.

Visual Quality Narrative Report

Report Description: A narrative on the stand's visual quality.

About this report: This report will give a general indication of the quality of the selected stand in regards to visual resources. Characteristics in the report include stand size class and forest type, major tree species, density, medial diameter and trees per unit area. The vegetation layers are described in terms of canopy closure of the overstory, the percentage and type (deciduous, coniferous, ericaceous) of cover in the midstory and shrub layers, and the percentage of cover and types of species found in the ground layer. Density is also reported in terms of screening ability.

Visual features are listed for each vegetation layer such as fall color species, flowering species, and fruit bearing species. Contrast is noted by comparing the percentage of evergreen and deciduous species, and any interesting trees in the tally are included in the report. Levels of coarse woody debris and slash are also listed.

- Slope, Stand Area, Land Cover Type, Forest Type, Stems Per Unit Area, Average DBH, Number of Big Trees Per Unit Area, Deciduous Shrub Layer, Deciduous Shrub Layer, Canopy Closure, Height to Bottom of Canopy, Total Midstory, Shrub Layer Percent Cover, Ground Layer Percent Cover.
- Fall Color, Fall Color Trees, Shrub Layer with Fall Color, Fall Color Ground Layer.
- Showy Flowers and Fruit Trees with Showy Flowers, Shrubs with Showy Flowers, Ground Layer with Showy Flowers, Trees with Fruits and Nuts, Shrub Layer with Fruits and Nuts, Ground Layer with Fruits and Nuts.
- Midstory, Deciduous Midstory, Coniferous Midstory, Mixed Midstory, Total Midstory.
- Coarse Woody Debris, Low Slash, High Slash.
- Other Features, Unique Features, Feature to Screen, Feature to Show.

Timber Narrative Report

Report Description: A narrative on timber in the stand.

About this report: This report will give a general indication of the quality of the selected stand in regard to timber resources. Many timber-related variables are assessed including site index, trees per acre, basal area, relative density, q factor, stand maturity, mean diameter, merchantable diameter and quadratic mean diameter. Volumes reported include pulp cord, total cord, pulp cubic, total cubic, sawlog cubic and board foot. Other information is given such as the basal area of trees considered of high value, whether roads are present or not and the percentage of the stand classified as wetland. The following variables are referenced:

- **Physiography:** Stand Area, Elevation, Aspect, Slope, Roaded, Average Haul Distance, Operability, Accessibility, Site Index, Site Index Species, Wetland, Riparian, Contains a Wetland, Contains a Riparian, Percent Area Wetland, Percent Area Riparian, Permanent Ponds.
- **Composition:** Basal Area of AGS, Size Class, Average DBH, Medial DBH, Merchantable Medial DBH, Quadratic Mean DBH.
- **Structure:** Relative Density, Q Factor, Year of Origin, Year of Maturity, Effective Age.
- **Timber volume** Net Board-Foot Volume, Net Pulpwood Volume, Net Merchantable Cubic Volume, Net Board-Foot Volume, Net Pulpwood Volume, Net Merchantable Cubic Volume.
- **Timber value** Board-Foot Value, Pulpwood Value, Dollar Value.
- **Regeneration Assessment** Deer Impact.

Water Narrative Report

Report Description: A narrative on water resources in the stand.

About this report: This report will give a general indication of the quality of the selected stand in regards to water resources. The report includes an indication of whether the stand is classified as, or contains a riparian or wetland area. Seeps and streams are also noted in the report as well as the percent of conifer and percent hardwood species and the percent regeneration of sprout origin.

Wildlife Narrative Report

Report Description: A narrative on wildlife in the stand.

About this report: This report will give a general indication of the quality of the selected stand in regards to wildlife habitat resources. The wetland status is noted in terms of the percentage of the stand that is classified as a riparian area and the percentage that is classified as wetland as well as whether or not streams and waterside logs are present on the stand. Overstory structure characteristics are listed such as percent basal area in conifers and hardwoods, the presence of hard and soft mast and the percent canopy closure. Midstory, shrub, and ground cover is indicated along with examples of the wildlife species it may provide habitat for. Other data reported includes litter and moss cover, dead and down woody debris, slash, rocky soil conditions, and the presence of seeps, high and low perches, and roads. Variables referenced by the report include the following:

- **Wetland Status:** Riparian, Contains a Riparian, Stream, Coarse Woody Debris in Water, Wetland, Contains a Wetland, Seeps.
- **Overstory Structure:** Percent Basal Area Conifer, Percent Basal Area Hardwoods, Hard Mast, Soft Mast, Canopy Closure.
- **Midstory:** Coniferous Midstory, Deciduous Midstory, Mixed Midstory.
- **Shrub Layer:** Shrub Layer Percent Cover, Coniferous Shrub Layer, Deciduous Shrub Layer, Ericaceous Shrub Layer.
- **Ground Cover/Forest Floor:** Ground Layer Percent Cover, Percent Cover of Leaf Litter, Litter Depth, Coarse Woody Debris, High Slash, Low Slash, Percent Cover Rock, Rock Crevices, Caves, Rock Piles.
- **Other Features:** High Perch, Low Perch, Roaded.
- **Goal Analysis:** Canopy Closure, Caves, Coniferous Midstory, Dead Cavity Tree, Deciduous Midstory, Forest Type, Coniferous Shrub Layer, Ground Layer Percent Cover, Deciduous Shrub Layer, Ericaceous Shrub Layer, Hard Mast, High Perch, Percent Cover of Leaf Litter, Live Cavity Tree, Loose Soils, Low Perch, Mixed Midstory, Permanent Ponds, Rock Crevices, Rock Piles, Percent Cover Rock, Seeps, Size Class, Soft Mast, Stream, Temporary Ponds, Shrub Layer Percent Cover.

Appendix D - Rules and Regulations

Sustainable Forest Management Certification

Interest in the sustainable management of forests for timber, timber, wildlife, watershed protection, carbon sequestration, and biofuels, as well as for controlling rates of deforestation, degradation, and illegally harvested materials, has led to increased acceptance and demand for certified forest products (Kraxner et al. 2008). Industry, retailers, and trade associations use forest certification to demonstrate their social and environmental responsibility (Kraxner et al. 2008). In addition to market pressure, forest certification can be used to ensure compliance with the Lacey Act as modified in 2008, which makes it a criminal offense in the United States to take possession of timber obtained, traded, or sold illegally, even when the act occurs outside the United States (Kraxner et al. 2008).

There are several independent forest certification organizations in North America. Forest certification organizations provide requirements for standard-setting, certification procedures, the accreditation of certification bodies, and mechanisms to control sustainability claims (FAO 2010). Certification procedures follow core guidelines that define the various elements of the certification process, including standards for sustainable forest management and the chain of custody. Chain of custody is the process whereby all individuals and companies, that process or sell forest products in the supply chain of a specific wood-based product, must certify that wood or wood-based products in their possession have originated from sustainably managed forests.

Portions of the following information was provided from each respective organization's website.

Forest Stewardship Council (FSC)

212 Third Avenue North, Suite 280
Minneapolis, Minnesota, 55401
Phone: 612-353-4511
Website: www.fscus.org

The Forest Stewardship Council (FSC) was formed following the 1992 Earth Summit in Rio de Janiero, Brazil, where world attention was focused on the challenges faced by cultures around the world as demands on their natural resources increased. Driven by challenges addressed in Rio, participants including loggers, foresters, environmentalists, and sociologists came together to form the FSC in 1993.

FSC was the first international certification system. It is comprised of 10 guiding principles including protection of biodiversity, maintenance of ecosystem services, respect for indigenous people's rights, and consideration of the long-term social and economic well-being of forest workers and local communities. Within these guiding principles there are 57 sustainable management criteria.

In 1995, FSC-US, located in Minneapolis, MN, was established as the national "chapter" of FSC. Its purpose is to coordinate the development of forest management standards throughout the different biogeographic regions of the United States, to provide public information about certification and FSC, and to work with certification organizations to promote FSC certification in the U.S. FSC-US has a national presence through the work of its Board of Directors, members, staff, and regional standards coordinators.

The FSC's international headquarters are located in Bonn, Germany. For more information on FSC at the international level, visit www.fsc.org.

Programme for the Endorsement of Forest Certification (PEFC)

The Programme for the Endorsement of Forest Certification (PEFC), formerly the Pan-European Forest Certification System, was launched in 1999, and is an umbrella organization that endorses otherwise independent forest certification schemes (FAO 2010). In North America, the Sustainable Forestry Initiative (SFI), the American Tree Farm System (ATFS), and the Canadian Standards Association Sustainable Forest Management Program (CSA) have been endorsed by PEFC.

PEFC has established a set of requirements, known as the PEFC Sustainability Benchmarks, which include a set of over 300 criteria that form the basis against which national independent certification systems such as SFI and ATFS are assessed during PEFC endorsement. PEFC bases its Sustainability Benchmarks on broad consensus by society, expressed in globally respected international and intergovernmental process and guidelines intended to promote environmentally sound, socially just, and economically viable management of forests globally.

Sustainable Forestry Initiative (SFI)

Sustainable Forestry Initiative Inc.
900 17th Street, NW, Suite 700
Washington, DC 20006
Phone: 202-596-3450
Website: www.sfiprogram.org

The Sustainable Forestry Initiative (SFI) was created in 1994 by the industry trade organization, the American Forest and Paper Association (AFPA). In 2005, SFI was endorsed by PEFC, and in 2007, SFI became completely independent of AFPA. SFI is designed specifically for certification of large forest tracts (Oliver and Kraxner 2009).

SFI is a fully independent, charitable organization dedicated to promoting sustainable forest management. It works with conservation groups, local communities, resource professionals, landowners, and countless other organizations and individuals who share a passion for responsible forest management.

The SFI Board of Directors represents environmental, social, and economic interests equally, and addresses local needs through a grassroots network of SFI Implementation Committees. The SFI forest certification standard is based on 14 core principles that promote sustainable

forest management, including measures to protect water quality, biodiversity, wildlife habitat, species at risk, and forests with exceptional conservation value. There are also 20 objectives, 39 performance measures, and 114 indicators, developed by professional foresters, conservationists, scientists, and others.

The SFI guidelines are intended to improve conservation of biodiversity in North America and elsewhere, address emerging issues such as climate change and bioenergy, strengthen SFI fiber sourcing requirements, complement SFI activities aimed at avoiding controversial or illegal off-shore fiber sources, expand requirements for logger training, and enhance support for trained loggers and certified logger programs.

American Tree Farm System (ATFS)

American Tree Farm System
c/o American Forest Foundation
1111 Nineteenth Street, NW
Suite 780
Washington, D.C. 20036
Phone: 202-463-2462
Website: www.treefarmsystem.org

The American Tree Farm System (ATFS) was created in 1941 when leaders from industry felt that America's private forests were being cut at unsustainable rates without reforestation. Tree Farms, recognized for their outstanding practices, would become demonstration sites to other forest owners - showing them the benefits of scientific forestry, and how to do it on their own land. ATFS is designed for smaller, private family forests (Oliver and Kraxner 2009). In 2008, ATFS was endorsed by PEFC.

ATFS has established standards and guidelines for property owners to meet to become a Certified Tree Farm. Under these standards and guidelines, private forest owners must develop a management plan based on strict environmental standards and pass an inspection by an ATFS volunteer forester every five years.

Canadian Standards Association (CSA) Sustainable Forest Management System (SFM)

CSA SFM User Group
4792 Tourney Road
North Vancouver, BC V7K 2W5
Canada
Website: www.csasfmforests.ca

In 1995, the Canadian Council of Forest Ministers produced a national framework of criteria and indicators to help track the nation's progress in achieving sustainable forest management (SFM). In the absence of an internationally accepted standard, the Canadian Standards Association (CSA) was asked to develop a voluntary standard for Canada. Created in 1996, it is Canada's official national standard for sustainable forest management. CSA SFM was endorsed by PEFC in 2005 (Kraxner et al. 2008). CSA SFM Standard is the leading forest certification standard in Canada.

Forests certified to the CSA SFM Standard provide independent third party assurance of meeting a strict set of biological, environmental, and social criteria. Recognizing that 95% of Canada's forests are publicly owned, the CSA certification demands active public involvement by local residents. From coast to coast, more than 50 public advisory groups are involved in frequent discussion each and every year with forest managers to continuously improve their performance.

The CSA SFM Standard has both performance requirements and management system requirements. All certifications to CSA SFM require, among other things, recognition of environmental, economic, social and cultural values, conservation of biological diversity, and ongoing public participation.

Society of American Foresters (SAF)

Society of American Foresters
5400 Grosvenor Lane
Bethesda, MD 20814-2198
Internet site: www.safnet.org

Information about the Society of American Foresters (SAF) was provided from their website at www.safnet.org, and is provided for the convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture.

Since 1900, SAF has provided access to information and networking opportunities to prepare members for the challenges and the changes that face natural resource professionals.

SAF core values are as follows:

- Forests are a fundamental source of global health and human welfare,
- Forests must be sustained through simultaneously meeting environmental, economic, and community aspirations and needs,
- Foresters are dedicated to sound forest management and conservation, and
- Foresters serve landowners and society by providing sound knowledge and professional management skills.

Mission Statement—SAF is the national scientific and educational organization representing the forestry profession in the U.S. Founded in 1900 by Gifford Pinchot, it is the largest professional society for foresters in the world. The mission of SAF is to advance the science, education, technology, and practice of forestry; to enhance the competency of its members; to establish professional excellence; and, to use the knowledge, skills, and conservation ethic of the profession to ensure the continued health and use of forest ecosystems and the present and future availability of forest resources to benefit society. SAF is a nonprofit organization meeting the requirements of 501 (c)(3). SAF members include natural resource professionals in public and private settings, researchers, chief executive officers, administrators, educators, and students.

For more detailed information about the organization, visit www.safnet.org.

Code of Ethics

Preamble: Service to society is the cornerstone of any profession. The profession of forestry serves society by fostering stewardship of the world's forests. Because forests provide valuable resources and perform critical ecological functions, they are vital to the well-being of both society and the biosphere.

Members of SAF have a deep and enduring love for the land, and are inspired by the profession's historic traditions, such as Gifford Pinchot's utilitarianism and Aldo Leopold's ecological conscience. In their various roles as practitioners, teachers, researchers, advisers, and administrators, foresters seek to sustain and protect a variety of forest uses and attributes, such as aesthetic values, air and water quality, biodiversity, recreation, timber production, and wildlife habitat.

The purpose of this Code of Ethics is to protect and serve society by inspiring, guiding, and governing members in the conduct of their professional lives. Compliance with the code demonstrates members' respect for the land and their commitment to the long-term management of ecosystems, and ensures just and honorable professional and human relationships, mutual confidence and respect, and competent service to society.

On joining SAF, members assume a special responsibility to the profession and to society by promising to uphold and abide by the following:

Principles and pledges:

1. Foresters have a responsibility to manage land for both current and future generations. We pledge to practice and advocate management that will maintain the long-term capacity of the land to provide the variety of materials, uses, and values desired by landowners and society.
2. Society must respect forest landowners' rights and correspondingly, landowners have a land stewardship responsibility to society. We pledge to practice and advocate forest management in accordance with landowner objectives and professional standards, and to advise landowners of the consequences of deviating from such standards.
3. Sound science is the foundation of the forestry profession. We pledge to strive for continuous improvement of our methods and our personal knowledge and skills; to perform only those services for which we are qualified; and in the biological, physical, and social sciences to use the most appropriate data, methods, and technology.
4. Public policy related to forests must be based on both scientific principles and societal values. We pledge to use our knowledge and skills to help formulate sound forest policies and laws; to challenge and correct untrue statements about forestry; and to foster dialogue among foresters, other professionals, landowners, and the public regarding forest policies.
5. Honest and open communication, coupled with respect for information given in confidence, is essential to good service. We pledge to always present, to the best of our ability, accurate and complete information; to indicate on whose behalf any public statements are made; to fully disclose and resolve any existing or potential conflicts of interest; and to keep proprietary information confidential unless the appropriate person authorizes its disclosure.

6. Professional and civic behavior must be based on honesty, fairness, good will, and respect for the law. We pledge to conduct ourselves in a civil and dignified manner; to respect the needs, contributions, and viewpoints of others; and to give due credit to others for their methods, ideas, or assistance.

Note*:* The Society of American Foresters' Bylaws specify processes through which a member's violation of the code may lead to reprimand, censure, expulsion from SAF, or other disciplinary action. Any two persons, whether or not SAF members, may charge a member with violation of the code. Such a charge must be made in writing to the SAF president and must refer to the specific pledges alleged to have been violated.

Adopted by SAF by Member Referendum, November 3, 2000, replacing the code adopted June 23, 1976, as amended November 4, 1986, and November 2, 1992. The 1976 code replaced the code adopted November 12, 1948, as amended December 4, 1971.

State Best Management Practices

Best Management Practices for the State of Connecticut

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Connecticut has implemented the concept of best management practices (BMPs) to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Connecticut Department of Environmental Protection
Division of Forestry
State Office Building, Room 260
79 Elm Street
P.O. Box 5066
Hartford, CT 06102-5066
Phone: (860) 424-3630
Website: www.ct.gov/dep

Published BMPs for Connecticut are available from the above office. Interested parties should request the booklet titled, *Timber Harvesting and Water Quality in Connecticut: A Practical Guide for Protecting Water Quality While Harvesting Forest Products*. Specific subject areas covered include the following:

- Site Planning Considerations
- Truck Roads, Skid Roads/Trails and Landings
- Drainage Structures
- Sediment Control Measures
- Post-Harvesting Considerations

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Delaware

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Delaware has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Delaware Department of Agriculture, Forestry Section
RD4 Box 354
Georgetown, DE 19947
Phone: (800) 282-8685
Website: http://dda.delaware.gov/forestry

Published BMPs for Delaware are available from the above office. Interested parties should request the booklet titled, *Forestry Best Management Practices for Delaware*. Specific subject areas covered include the following:

- Preharvest Planning
- Truck Haul Roads
- Skid Trails
- Log Decks, Landings, and Portable Sawmill Locations
- Streamside Management Zones
- Drainage Structures
- Stream Crossings
- Site Preparation and Management
- Revegetation of Bare Soil Areas
- Wildfire Control and Reclamation

The booklet also lists separate BMPs for forested wetlands, including the following:

- Salvage and Sanitation in Streamside Management Zones
- Forested Wetlands Preharvest Planning
- Forested Wetlands Truck Haul Roads
- Forested Wetlands Skid Trails
- Forested Wetlands Log Decks

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Illinois

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Illinois has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Illinois Department of Conservation
Division of Forest Resources
600 North Grand Avenue West
Springfield, IL 62706
Phone: (217) 333-2770
Website: http://web.extension.illinois.edu/forestry

Published BMPs for Illinois are available from the above office. Interested parties should request the information in the resource titled, *Illinois 208 Water Quality Management Plan: Recommended Best Management Practices for Forestry,* in pp. 337-358. Specific subject areas covered include the following:

- Forest Management Planning
- Road Systems
- Drainage Systems
- Logging Systems
- Streamside Management Zones
- Site Disturbance
- Pesticide Use
- Fertilizer Use

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Indiana

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Indiana has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Indiana Department of Natural Resources
Division of Forestry
402 West Washington Street, Room #296
Indianapolis, IN 46204
Phone: (317) 232-4105
Website: www.in.gov/dnr/forestry

Published BMPs for Indiana are available from the above office. Interested parties should request the booklet titled, *Logging Roads and Skid Trails: A Guide for Soil Protection and Timber Management*. Specific subject areas covered include the following:

- Planning Roads and Locations
- Logging Operations
- Closing Roads and Trails After Logging
- Bridges and Culverts
- Buffer Strips
- Waste Disposal

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Iowa

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Iowa has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water

bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Department of Natural Resources
Wallace Office Building
502 East 9th Street
Des Moines, IA 50319
Phone: (515) 281-5918
Website: www.iowadnr.gov/forestry/

Best Management Practices for the State of Maine

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Maine has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Department of Conservation
Maine Forest Service
Harlow Building, SHS #22
Augusta, ME 04333
Phone: (800) 367-0223
Website: www.maine.gov/doc/mfs/pubs.htm

Published BMPs for Maine are available from the above office. Interested parties should request the booklet titled, *Best Management Practices - Field Handbook 1992*. Specific subject areas covered include the following:

- Preharvest Planning
- Roads, Trails, Landings
- Erosion Control Devices
- Stream Crossings

The booklet also lists several BMPs for other activities affecting water quality including the following:

- Herbicides and Insecticides
- Oils, Fuels, Coolants, and Hazardous Wastes
- Protection of Permanent Streams and Water Bodies from
- Temperature Increases and Siltation
- Seeding and Revegetation
- Slash
- Temporary Salt and Sand Storage Areas
- Sediment Barriers

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Maryland

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Maryland has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Maryland Department of Natural Resources, Forest Service
Tawes State Office Building, E-1
580 Taylor Avenue
Annapolis, MD 21401
Phone: (410) 260-8531
Website: www.dnr.state.md.us/forests/

Published BMPs for Maryland are available from the above office. Interested parties should request the booklet titled, *Soil Erosion and Sediment Control Guidelines for Forest Harvest Operations in Maryland*. Specific subject areas covered include the following:

- Preharvest Planning
- Truck Haul Roads
- Skid Trails
- Log Decks, Landings, and Portable Sawmill Locations
- Streamside Management Zones
- Drainage Structures

- Stream Crossings
- Site Preparation
- Revegetation of Bare Soil Areas
- Wildfire Control and Reclamation

The booklet also lists separate BMPs for forested wetlands, including the following:

- Natural Regeneration
- Preharvest Planning
- Truck Haul Roads
- Skid Trails
- Log Decks
- Streamside Management Zones
- Cross Drainages

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Massachusetts

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Massachusetts has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Department of Environmental Management
Division of Forests and Parks
100 Cambridge Street, 19th Floor
Boston, MA 02202
Phone: (617) 727-3180
Website: www.mass.gov/dep/water/drinking/forstbmp.pdf

Published BMPs for Massachusetts are available from the above office. Interested parties should request the booklet titled, *Massachusetts Best Management Practices: Timber Harvesting Water Quality Handbook*. Specific subject areas covered include the following:

- Skid Trail Erosion Control
- Access Road Erosion Control

- Erosion Control Measures on Landings
- Erosion Control for Stream Crossings
- Filter and Buffer Strips
- Wetland Operations
- Seeding of Skid Trails and Landings
- Completion of Operations

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Michigan

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Michigan has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Michigan Department of Natural Resources
P.O. Box 30452
Lansing, MI 48909-7952
Phone: (517) 335-3330 (Forest Planning and Operations Supervisor, BMP Program)
Website: http://www.michigan.gov/dnr

Published BMPs for Michigan are available from the above office. Interested parties should request the booklet titled, *Water Quality Management Practices on Forest Land*. Specific subject areas covered include the following:

- Timber Harvesting
- Planning
- Equipment Operations and Maintenance
- Buffer Strips
- Haul Roads and Skid Trails
- Planning
- Construction
- Water and Erosion Control Structures
- Maintenance
- Site Preparation and Reforestation

- Mechanical
- Prescribed Burning
- Chemical Treatment
- Reforestation
- Forest Protection
- Pesticides
- Wildfire Damage Control and Reclamation
- Livestock Exclusion

The booklet also lists state and federal laws related to nonpoint source pollution control which require landowner permits.

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Minnesota

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Minnesota has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Minnesota Department of Natural Resources
Division of Forestry
500 Lafayette Road
St. Paul, MN 55155-4001
Phone: (612) 297-4924

Published BMPs for Minnesota are available from the above office. Interested parties should request the booklet titled, *Water Quality in Forest Management: Best Management Practices in Minnesota*. Specific subject areas covered include the following:

- Fuel, Lubricant, and Equipment Maintenance
- Filter Strips
- Forest Roads
- Design
- Construction
- Maintenance
- Timber Harvesting

- Mechanical Site Preparation
- Pesticide Use
- Planning
- Procedures
- Prescribed Burning

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Missouri

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Missouri has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Missouri Department of Conservation
Forestry Division
P.O. Box 180
Jefferson City, MO 65102-0180
Phone: (573) 884-6861
Website: http://mdc.mo.gov/landwater-care/plant-management/forest-and-tree-management

Published BMPs for Missouri are available from the above office. Interested parties should request the booklet titled, *Missouri Watershed Protection Practices: Management Guidelines for Maintaining Forested Watersheds to Protect Streams*. Specific subject areas covered include the following:

- Streamside Zones
- Stream Crossings
- Access Roads
- Timber Harvesting
- Site Preparation
- Reforestation
- Prescribed Burning
- Chemical Treatment

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of New Hampshire

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, New Hampshire has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Division of Forests and Lands Resources
Department of Resources and Economic Development
P.O. Box 856
Concord, NH 03301
Phone: (603) 271-2214
Website: http://www.nhdfl.org/

Published BMPs for New Hampshire are available from the above office. Interested parties should request the booklet titled, *Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire*. Specific subject areas covered include the following:

- Preharvest Planning
- Truck Haul Roads
- Skid Trails
- Log Landings
- Erosion Control Devices
- Stream Crossings
- Final Stabilization - Haul Road, Skid Trail, Landings

The booklet also lists several laws and regulations regarding timber harvesting activities.

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of New Jersey

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, New Jersey has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads,

stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

New Jersey Forest Service
501 East State Street
CN-404
Trenton, NJ 08625
Phone: (609) 292-2520
Website: http://www.state.nj.us/dep/parksandforests/forest/

Published BMPs for New Jersey are available from the above office. Interested parties should request the booklet titled, *Best Management Practices for New Jersey Silviculture as They Relate to Water Quality*. Specific subject areas covered include the following:

- Improved Harvesting
- Seeding and Planting
- Prescribed Burning
- Biological and Chemical Insect Control
- Protection from Livestock

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of New York

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, New York has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

New York State Department of Environmental Conservation
Division of Lands and Forests
50 Wolf Road
Albany, NY 12233-4252
Phone: (518) 402-9405
Website: http://www.dec.ny.gov/

Published BMPs for New York are available from the above office. Interested partied should request the booklet titled, *Silviculture Management Practices Catalogue for Nonpoint Source Pollution Prevention and Water Quality Protection in New York State*. Specific subject areas covered include the following:

- Planned Harvest Operations
- Planned Access Routes
- Riparian Buffer Protection
- Planned Watercourse Crossings
- Road Water Management
- Sediment Barriers
- Hazardous Material Management
- Vegetation Establishment

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Ohio

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Ohio has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Ohio Department of Natural Resources
Division of Forestry
1855 Fountain Square Court, H-1
Columbus, OH 43224-1327
Phone: (614) 265-6703 or 1-877-247-8733
Website: http://www.dnr.state.oh.us/

Published BMPs for Ohio are available from the above office. Interested parties should request the booklet titled, *BMPs for Erosion Control on Logging Jobs in Ohio*. Specific subject areas covered include the following:

- Planning Logging Operations
- Haul Roads

- Skid Roads
- Maintenance
- Stream Crossings
- Filter and Shade Strips
- Landings
- Sale Closing

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Pennsylvania

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Pennsylvania has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Commonwealth of Pennsylvania
Department of Environmental Resources, Bureau of Forestry
Division of Forest Advisory Services
400 Market Street, 3rd Floor
P.O. Box 8552
Harrisburg, PA 17105-8552
Phone: (717) 787-3444
Website: http://www.dcnr.state.pa.us/

Published BMPs for Pennsylvania are available from the above office. Interested parties should request the booklet titled, *Controlling Erosion and Sedimentation from Timber Harvesting Operations*. Specific subject areas covered include the following:

- Designing the Road System
- Water and Sedimentation Control Structures
- Stream Crossings
- Skid Roads, Skid Trails, and Log Landings
- Road and Log Landing Retirement
- Erosion and Sediment Control Plan for Harvesting

The booklet titled, *Best Management Practices for Silvicultural Activities in Pennsylvania's Forest Wetlands,* lists separate BMPs for forested wetlands, including the following:

- Haul Roads
- Felling
- Skidding
- Landings
- Buffer Zones - Temporary Ponds, Spring Seeps, Streams

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Rhode Island

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Rhode Island has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Department of Environmental Management
Division of Forest Environment
1037 Hartford Pike
North Scituate, RI 02857
Phone: (401) 647-3367
Website: http://www.dem.ri.gov/programs/bnatres/forest

Published BMPs for Rhode Island are available from the above office. Interested parties should request the booklet titled, *Best Management Practices for Rhode Island: Timber Harvesting, Forest Protection, and Water Quality*. Specific subject areas covered include the following:

- Logging Roads and Skid Trails
- Planning and Construction
- Maintenance
- Landings
- Forest Wetlands
- Forest Protection
- Insect and Diseases
- Fire

- Soils and Productivity
- Wildlife
- Boundaries
- Harvesting
- Laws and Regulations

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Vermont

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Vermont has implemented the concept of acceptable management practices (AMPs), equivalent to other states' BMPs, to protect against water pollution. AMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, AMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable AMPs:

Agency of Natural Resources
Department of Forests, Parks, and Recreation
103 South Main Street - 10 South
Waterbury, VT 05671-0601
Phone: (802) 241-3678
Website: http://www.anr.state.vt.us/cleanandclear/forestry.htm

Published AMPs for Vermont are available from the above office. Interested parties should request the booklet titled, *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont*. Specific subject areas covered include the following:

- Truck Roads
- Skid Trails
- Surface Water and Stream Crossings
- Protective Strips
- Log Landings

The booklet also lists several laws and regulations regarding timber harvesting activities.

Caution: Other local and/or regional AMPs may also apply. Inquire about any additional AMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of West Virginia

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, West Virginia has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

West Virginia Division of Forestry
1900 Kanawha Blvd., East
State Capitol Bldg. 13
Charleston, WV 25305-0180
Phone: (304) 558-3446
Website: http://www.wvforestry.com/

Published BMPs for West Virginia are available from the above office. Interested parties should request the booklet titled, *Clean Streams Handbook for Loggers - Keeping Mud Out of the Streams*. Specific subject areas covered include the following:

- Planning the Operation
- Filter Strips
- Constructing Logging Roads and Landings
- Maintaining Logging Roads and Landings
- Retiring Logging Roads and Landings

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester.

Best Management Practices for the State of Wisconsin

By Federal law, activities associated with growing and harvesting forests are considered as potential nonpoint sources of water pollution. Like all states with substantial forest lands, Wisconsin has implemented the concept of BMPs to protect against water pollution. BMPs are guidelines that help accomplish management objectives for your stand while protecting surface waters and groundwaters against sedimentation, temperature and chemical changes, and pesticide contamination. Typically, BMPs address planning and construction of skid trails, logging roads, stream crossings, and landing areas; installation of water control devices such as culverts, water bars, and drainage ditches; management activities in riparian areas bordering streams, wetlands, and lakes; and rehabilitation of disturbed areas upon completion of logging.

Before undertaking any forest management activity that may impact water quality, you must contact the following office to obtain information on applicable BMPs:

Wisconsin Department of Natural Resources, Forest Service
101 South Webster Street
P.O. Box 7921
Madison, WI 53707-7921
Phone: (608) 267-7494
Website: http://dnr.wi.gov/forestry/usesof/bmp/

Published BMPs for Wisconsin are available from the above office. Interested parties should request the booklet titled, *Forest Practice Guidelines for Wisconsin*. Specific subject areas covered include the following:

- Forest Management Plans
- Forest Accessways
- Timber Harvesting
- Reforestation
- Integrated Pest Management

Caution: Other local and/or regional BMPs may also apply. Inquire about any additional BMPs from the office listed above, or from your county or extension forester

Appendix E - Silvicultural Guidelines for Timber Production

Board-foot Production

Silvicultural Guidelines for Board-foot Production in Aspen-Birch Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the board-foot production goal in aspen-birch stands. Aspen-birch guidelines are as follows:

- Stands should be a minimum of 10 acres.
- Better quality sites are preferred, and a minimum site index of 60 for aspen is recommended.
- A minimum of 60 square feet/acre in basal area of acceptable growing stock (AGS) is recommended.
- A rotation length of 50-90 years is appropriate.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- Prior to the end of the rotation, when the basal area reaches 120−140 square feet per acre, thin once back to 60-70 square feet per acre.
- At the end of the rotation, clearcut the stand when it is mature.

  Note: If the birch component is important, release birch in the sapling stage.

Two-age Management could be used to achieve the board-foot production goal in aspen-birch stands but would not be as effective as even-age management or patch cutting. Guidelines for using two-age management in aspen-birch stands are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the board-foot production goal in aspen-birch stands. Aspen-birch guidelines are as follows:

- Stands should be a minimum of 10 acres.
- Better quality sites are preferred, and a minimum site index of 60 for aspen is recommended.
- A minimum of 60 square feet per acre in basal area of AGS is recommended.
- A rotation length of 50-90 years is appropriate.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- Prior to the end of the rotation, when the basal area reaches 120−140 square feet per acre, thin once back to 60-70 square feet per acre.
- At the end of the rotation, do a patch cut when the stand is mature.

  Note: If the birch component is important, release birch in the sapling stage.

Group Selection could be used to achieve the board-foot production goal in aspen-birch stands but would not be as effective as even-age management or patch cutting. Guidelines for using "group selection" in aspen-birch stands for this goal are not available at this time.

Single-tree Selection will not achieve the board-foot production goal in aspen-birch stands.

No Cutting will not achieve the board-foot production goal.

Silvicultural Guidelines for Board-foot Production in Allegheny Hardwood Stands

Even-age Management is the "best" silvicultural system to use to achieve the board-foot production goal in Allegheny hardwoods. Allegheny hardwood guidelines are as follows:

- Optimum rotation age is 90 years, with a range of 80−110 years. If the % basal area in CAPS (cherry, ash, yellow-poplar) is ≥ 50%, a shorter rotation is recommended, otherwise use a longer rotation.
- A minimum of 30% in acceptable growing stock (AGS) is acceptable.
- No cutting is required for the first 45 years of the rotation.
- At 45–70 years—60 years is optimum, perform a first commercial thinning predominantly from below to a residual density of 60%.
- From 60–85 years (15 years after the first thinning) perform a second commercial thinning predominantly from below to a residual density of 60%.
- From 70–95 years (10 years after the second thinning) examine the advance regeneration and do a first cut in a shelterwood sequence if necessary.
- At the end of the rotation (15 years after the second thinning), do a second cut of a shelterwood sequence or a clearcut. A deferment cut is acceptable if clearcutting is not allowed, retaining up to 10 square feet per acre of basal area.

Two-age Management is the "next best" silvicultural system to use to achieve the board-foot production goal in Allegheny hardwoods. Allegheny hardwood guidelines are as follows:

- Optimum rotation age is 90 years, with a range of 80−110 years. If the % basal area in CAPS (cherry, ash, yellow-poplar) is ≥ 50%, a shorter rotation is recommended, otherwise use a longer rotation.
- A minimum of 30% in AGS is acceptable.
- For the first 45 years, no work is required. Depending on stocking level, a thinning at 35 years may be necessary.
- At 45 years, harvest the older age class, leaving a 30% residual density.
- From 45–90 years, no work is required. Depending on stocking, however, thinning every 8 years may be necessary.
- At the end of the rotation, harvest the older age class, leaving a 30% residual density.

Patch Cutting could be used to achieve the board-foot production goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using "patch cutting" in Allegheny hardwoods for board-foot production are not available at this time.

Group Selection could be used to achieve the board-foot production goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using "group selection" in Allegheny hardwoods for board-foot production are not available at this time.

Single-tree Selection could be used to achieve the board-foot production goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using "single-tree selection" in Allegheny hardwoods for board-foot production are not available at this time.

No Cutting will not achieve the board-foot production goal.

Silvicultural Guidelines for Board-foot Production in Appalachian Hardwood Stands

Even-age management is considered the "best" silvicultural system to use to achieve the board-foot production goal in Appalachian hardwoods. Appalachian hardwood guidelines are as follows:

- Optimum rotation age is 80 years, with a minimum of 70 and a maximum of 120 years.
- A minimum of 30% of acceptable growing stock (AGS) is recommended.
- For the first 15 years, examine the stand and consider precommercial cultural practices such as removal of grapevines, timber stand improvement (TSI), and possibly selecting crop trees.
- From 15-40 years, consider precommercial cultural treatments.
- From 40-65 years, consider a maximum of two commercial thinnings depending on markets and rotation age.
- From 70−120 years, harvest.

Two-age Management is considered the "next best" silvicultural system to use to achieve the board-foot production goal in Appalachian hardwoods. Appalachian hardwood guidelines are as follows:

- Optimum rotation age is 80 years, with a minimum of 70 and a maximum of 160 years.
- A minimum of 30% of AGS is recommended.
- For the first 15 years, examine the stand and consider precommercial cultural practices such as removal of grapevines, timber stand improvement (TSI), and possibly selecting crop trees.
- From 15 years to the end of the rotation, consider precommercial cultural treatments.
- At the end of the rotation, cut the older age class.

Patch Cutting could be used to achieve the board-foot production goal in Appalachian hardwoods but would not be as effective as even age or two-age management. Guidelines for using "patch cutting" in Appalachian hardwoods for board-foot production are not available at this time.

Group Selection could be used to achieve the board-foot production goal in Appalachian hardwoods but would not be as effective as even age or two-age management. Guidelines for using "group selection" in Appalachian hardwoods for board-foot production are not available at this time. If this system is used, it is recommended that openings be 1/2 acre in size or larger.

Single-tree Selection will not achieve the board-foot production goal.

No Cutting will not achieve the board-foot production goal.

Silvicultural Guidelines for Board-foot Production in Hemlock Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the board-foot production goal in hemlock hardwoods stands if the stand currently has an even age structure. Hemlock hardwood guidelines are as follows:

- A rotation age of 80−120 years is recommended.
- A minimum of 50–60 square feet per acre of acceptable growing stock (AGS) is recommended.
- For the first 50 years, no cutting is required.
- At 50 years, thin to the B line on the Tubbs (1977) stocking guide.
- From 50–65 years, no cutting is required.
- From 65–70 years thin to the B line on the Tubbs (1977) stocking guide.
- If a shorter rotation is being used, from 70-80 years no cutting is required. At 80 years, do a first cut in a shelterwood sequence.
- If a longer rotation is being used, from 70–90 years thin to the B line on the Tubbs (1977) stocking guide. From 90−10 years do a first cut in a shelterwood sequence.

Two-age Management could achieve the board-foot production goal in hemlock hardwoods stands but would not be as effective as using even-age management or group selection. Guidelines for using two-age management in hemlock hardwoods stands for this goal are not available at this time.

Patch Cutting could achieve the board-foot production goal in hemlock hardwoods stands but would not be as effective as even-age management or group selection. Guidelines for using patch cutting in hemlock hardwoods stands for this goal are not available at this time.

Group Selection is considered the "best" silvicultural system to use to achieve the board-foot production goal in hemlock hardwoods stands if the stand currently has an uneven age structure. Hemlock hardwood guidelines are as follows:

- A cutting cycle of 15 years is optimum but earlier at first to establish structure.
- The maximum diameter to retain for hemlock is 18 inches because of shake problems, and a maximum diameter of 22 inches is recommended for hardwoods.
- When the stand basal area reaches 150−180 square feet per acre, cut back to 130 square feet per acre or within a range of 120−150 square feet per acre for pure hemlock stands.

Single-tree Selection could achieve the board-foot production goal in hemlock hardwoods stands but would not be as effective as using even-age management or group and single-tree selection. Guidelines for using single-tree selection in hemlock hardwoods stands for this goal are not available at this time.

No Cutting will not achieve the board-foot production goal in hemlock hardwoods stands.

Silvicultural Guidelines for Board-foot Production in Northern Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the board-foot production goal in northern hardwoods if the stand is currently in an even-age structure. Northern hardwood guidelines are as follows:

- A rotation age of 120 is recommended.
- For the first 60 years, no cutting is required.
- From 60–70 years, conduct a first thinning.
- From 70–90 years, an optional second thinning may be done.
- At the end of the rotation, harvest the stand with a clearcut if the site allows. In Vermont, a shelterwood sequence may be desirable.

Two-age Management could achieve the board-foot production goal in northern hardwoods but would not be as effective as even-age management, group selection or single-tree selection. Guidelines for using two-age management in northern hardwoods for this goal are not available at this time.

Patch Cutting could achieve the board-foot production goal in northern hardwoods but would not be as effective as even-age management, group selection or single-tree selection. Guidelines for using patch cutting in northern hardwoods for this goal are not available at this time.

Group Selection is considered the "best" silvicultural system to use to achieve the board-foot production goal if the stand is currently in an uneven age structure. Northern hardwood guidelines are as follows:

- The maximum diameter to retain is 22 inches.
- A q factor of 1.3−1.6 is recommended.
- A cutting cycle of 15−20 years is appropriate.
- If the basal area is less than 100 square feet per acre, no cutting is required.
- If the basal area is at least 100 square feet per acre, conduct group selection such that the overall residual, including both groups and areas between groups, should target 70-75 square feet per acre. Individual trees between groups may be cut as needed.

Single-tree Selection is considered the "next best" silvicultural system to use to achieve the board-foot production goal in northern hardwoods. Northern hardwood guidelines are as follows:

- The maximum diameter to retain is 22 inches.
- A q factor of 1.3−1.6 is recommended.
- A cutting cycle of 15−20 years is appropriate.
- For trees over 5 inches diameter at breast height (dbh), if the basal area is less than 100 square feet per acre, no cutting is required.
- If the basal area of trees over 5 inches dbh is at least 100 square feet per acre, conduct single-tree selection to a basal area of 70–75 square feet per acre.

No Cutting will not achieve the board-foot production goal.

Silvicultural Guidelines for Board-foot Production in Oak-hickory Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the board-foot production goal in oak-hickory stands. Oak-hickory guidelines are as follows:

- A rotation age of 80−120 years is recommended, with 90 years being the average.
- A minimum of 30% of acceptable growing stock (AGS) is recommended.
- For the first 10 years, no work is required.
- From 10−20 years, examine the stand and consider precommercial practices such as grapevine removal, timber stand improvement (TSI), and possibly selecting crop trees.
- From 20–40 years, consider precommercial cultural treatments.
- From 40–75 years, consider a maximum of two commercial thinnings depending on markets and rotation age.
- From 75 years to the end of the rotation, no work is required.
- At the end of the rotation, do a clearcut.

Two-age Management could be used to achieve the board-foot production goal in oak-hickory stands but would not be as effective as using even-age management or patch cutting. Guidelines for using two-age management in oak-hickory stands are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the board-foot production goal in oak-hickory stands. Oak-hickory guidelines are as follows:

- A re-entry period of 10−20 years is recommended, with 15 years being optimal.
- A rotation age of 80−120 years is recommended, with 90 years being optimal.
- A minimum of 30% of AGS is recommended.

For each patch:

- At each entry, thin if needed between the patches.
- For the first 10 years, no work is required.
- From 10−20 years, examine the stand and consider precommercial practices such as grapevine removal, TSI, and possibly selecting crop trees.
- From 20–40 years, consider precommercial treatments.
- From 40–75 years, consider a maximum of two commercial thinnings depending on markets and rotation age.
- From 75 years to the end of the rotation, no work is required.
- At the end of the rotation, do a clearcut.

Group Selection could achieve the board-foot production goal in oak-hickory stands but would not be as effective as even-age management or patch cutting. Guidelines for using group selection in oak-hickory stands for this goal are not available at this time.

Single-tree Selection will not regenerate the oak-hickory type. On better sites the type will change to yellow poplar and mixed hardwoods. On poorer sites the type will change to a mixture of tolerant species.

No Cutting will not achieve the board-foot production goal.

Silvicultural Guidelines for Board-foot Production in Oak-Northern Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the board-foot production goal in oak-northern hardwoods stands. Oak-Northern Hardwood guidelines are as follows:

- A minimum of 25 feet tall for release.
- Conduct precommercial thinnings until age 40–50 years.
- An optimal rotation age of 100 years is recommended, or within a range of 80−120 years.
- A cutting period of 10 years, with a range of 8−12 years is recommended.
- For the first 10 years, retain a minimum of 30 codominant northern red oak stems/acre—more is better. Maximize the number of red oaks.
- From 10–40 years, do precommercial thinning to the B line on the New England northern red oak stocking chart.
- From 40–70 years, do commercial thinning to the B line.
- At 70 years, establish oak regeneration, using non-commercial techniques as developed by Loftis (1993).
- At 80 years, conduct a first-cut shelterwood.
- At 100 years, conduct a removal-cut shelterwood.

  If you have a deer problem, there is a good chance that the understory may not be oak.

Two-age Management is considered the "next best" silvicultural system (along with patch cutting) to use to achieve the board-foot production goal in oak-northern hardwoods stands. Oak-Northern Hardwood guidelines are as follows:

- An optimal rotation age of 100 years is recommended.
- A cutting period of 50 years is recommended.
- For the first 50 years, no work is required in the younger age class.
- From 50−100 years, cut the older age class.

Patch Cutting is considered the "next best" silvicultural system (along with two-age management) to use to achieve the board-foot production goal in oak-northern hardwoods. Oak-Northern Hardwood guidelines are as follows:

- A minimum of 25 feet tall for release.
- Conduct precommercial thinnings until age 40-50 years.
- An optimal rotation age of 100 years is recommended, or within a range of 80−120 years.

- A cutting period of 10 years, with a range of 8−12 years is recommended.
- For the first 10 years, retain a minimum of 30 codominant northern red oak stems/acre—more is better. Maximize the number of red oaks.
- From 10–40 years, do precommercial thinning to the B line on the New England northern red oak stocking chart.
- From 40–70 years, do commercial thinning to the B line.
- At 70 years, establish oak regeneration, using non-commercial techniques as developed by Loftis (1993).
- At 80 years, conduct a first-cut shelterwood.
- At 100 years, conduct a removal-cut shelterwood.

  If you have a deer problem, there is a good chance that the understory may not be oak.

Group Selection should not be used to achieve the board-foot production goal in oak-northern hardwoods because forest type is likely to convert to northern hardwoods.

Single-tree Selection should not be used to achieve the board-foot production goal in oak-northern hardwoods because forest type is likely to convert to northern hardwoods.

No Cutting will not achieve the board-foot production goal.

Silvicultural Guidelines for Board-foot Production in Spruce-Fir Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the board-foot production goal in spruce-fir stands if the stand is currently in an even age structure. Spruce-fir guidelines are as follows:

- A rotation age of 80–90 years is recommended.
- For the first 9 years, no work is required.
- From 9−11 years, do a precommercial thinning when tree height is 6−10 feet if stocking ≥ 40% and there are at least 3,000 stems/acre.
- From 11−35 years, no work is required.
- At approximately 35 years, when the basal area is 120-140 square feet per acre, do a first commercial thinning back to 80−100 square feet per acre—no lower than the B line on the stocking chart.
- From 36–60 years, no work is required.
- From 60–65 years, do a second commercial thinning when basal area reaches 150−160 square feet per acre. Thin back to 110−120 square feet per acre.
- From 65–80 years, no work is required.
- At 80 years, begin a shelterwood sequence. Do a first cut shelterwood, removing 35% (one-third of stand). Take out unwanted trees such as the fir and leave trees you want for seed.
- After that, do a second cut in shelterwood—removing two-thirds of what is remaining. Focus on getting spruce regeneration.

- Remove the overstory when the stand is adequately stocked (i.e., greater than 40-50% stocking of desirable seedlings). **Note**: If you have a hardwood problem you need to make sure softwood seedlings are 2–4 feet before removing the overstory in the third shelterwood cut.

Two-age Management could be used to achieve the board-foot production goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using two-age management in spruce-fir stands for this goal are not available at this time.

Patch Cutting could be used to achieve the board-foot production goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using patch cutting in spruce-fir stands for this goal are not available at this time.

Group Selection is considered the "best" silvicultural system to use to achieve the board-foot production goal in spruce-fir stands if the stand is currently in an uneven age structure. Spruce-fir guidelines are as follows:

- The desired q factor is 1.7−2.0.
- Maximum diameter to be retained is 20 inches diameter at breast height.
- A cutting cycle of 10−15 years is recommended or when the basal area reaches 130−135 square feet per acre cut it back to 80-90 square feet. Thin within groups when tree height is 6−12 feet in order to favor spruce.

Single-tree Selection could be used to achieve the board-foot production goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using single-tree selection in spruce-fir stands for this goal are not available at this time.

No Cutting will not achieve the board-foot production goal.

Silvicultural Guidelines for Board-foot Production in Spruce-Hardwood Stands

Even-age Management is considered the "next best" silvicultural system for achieving the board-foot production goal in spruce-hardwoods stands if the softwoods are taller than the hardwoods. Spruce-hardwood guidelines are as follows:

- A rotation age of 120 years is recommended.
- For the first 40 years, no work is required.
- From 40-50 years, thin the stand, such that when the basal area of trees ≥5 inches diameter at breast height (dbh) reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- From 50–60 years, no work is required.
- From 60–70 years, do a second thinning when the basal area reaches 100−120 square feet per acre, cut it back down to 80 square feet and take out paper birch to release spruce.
- From 70–80 years, no work is required.

- From 80–90 years, do a third thinning when the basal area reaches 100−120 square feet per acre, cut it back down to 80 square feet.
- From 90−100 years, no work is required.
- At 100 years, begin a three-cut shelterwood sequence.

Two-age Management could achieve the board-foot production goal in spruce-hardwoods stands but would not be as effective as using group selection, single-tree selection, or even-age management. Guidelines for using two-age management in spruce-hardwoods stands for this goal are not available at this time.

Patch Cutting could achieve the board-foot production goal in spruce-hardwoods stands but would not be as effective as using group selection, single-tree selection, or even-age management. Guidelines for using patch cutting in spruce-hardwoods stands for this goal are not available at this time.

Group Selection is considered the "best" silvicultural system to use to achieve the board-foot goal in spruce-hardwoods stands. Spruce-hardwood guidelines are as follows:

- A maximum of 0.25 acre group size is recommended.
- A q factor of 1.4−1.8 is recommended, and 1.6 is optimal.
- Maximum diameter to be retained is 22 inches dbh.
- A cutting cycle of 15−20 years is recommended.
- When the basal area of trees ≥5 inches dbh reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- When the basal are reaches 120−140 square feet, cut back to a basal area of 80−100 square feet.

Single-tree Selection is considered the "next best" silvicultural system to use to achieve the board-foot production goal in spruce-hardwoods stands if the hardwoods are taller than the softwoods. Spruce-hardwood guidelines are as follows:

- A q factor of 1.4−1.8 is recommended, and 1.6 is optimal.
- Maximum diameter to be retained is 22 inches dbh.
- A cutting cycle of 15−20 years is recommended.
- When the basal area of trees ≥5 inches dbh reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- When the basal are reaches 120−140 square feet, cut back to a basal area of 80−100 square feet.

No Cutting will not achieve the board-foot production goal.

Silvicultural Guidelines for Board-foot Production in White Pine Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the board-foot production goal in white pine stands. White pine guidelines are as follows:

- A rotation age of 90 years (+/- 30) is appropriate, and 80−100 years is optimal.
- For the first 40 years, examine stand conditions to see if a cleaning is warranted.
- At 40 years, until 20 years before the rotation age, conduct a thinning when stocking reaches the midpoint between the A and B lines on the stocking chart. Thin back to the B line. Continue thinning in this manner until 20 years prior to the end of the rotation.
- At the end of the rotation, begin a two-cut shelterwood sequence because of potential white pine weevil problems.

Two-age Management could be used to achieve the board-foot production goal in white pine stands but would not be as effective as using even-age management or group selection. Guidelines for two-age management are not available at this time.

Patch Cutting could be used to achieve the board-foot production goal in white pine stands but would not be as effective as using even-age management or group selection. Guidelines for patch cutting are not available at this time.

Group Selection is considered the "next best" silvicultural system to use to achieve the board-foot production goal in white pine stands. White pine guidelines are as follows:

- A q factor of 1.3−1.8 is appropriate, and 1.5 is optimal.
- Maximum diameter to be retained is 30 inches diameter at breast height (dbh).
- A cutting cycle of 10–40 years is recommended, with 10−20 years optimal.
- Group size should be equivalent to 1/2−1 full tree height across.
- Make groups where regeneration already exists.

Single-tree Selection will not achieve the board-foot production goal in white pine stands.

No Cutting will not achieve the board-foot production goal.

Cubic-foot Production

Silvicultural Guidelines for Cubic-foot Production in Aspen-Birch Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in aspen-birch stands. Aspen-birch guidelines are as follows:

-
- Stands should be a minimum of 10 acres.
- Use a minimum rotation length of 40 years and a maximum of 70 years on better-quality sites. A rotation of 50 years is suitable for low-quality sites.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.

- No maintenance of the stand is required until the end of the rotation.
- At the end of the rotation, clearcut the stand when it is mature.

  Note: If the birch component is important, release birch in the sapling stage.

Two-age Management could be used to achieve the cubic-foot production goal in aspen-birch stands but would not be as effective as even age or patch cutting. Guidelines for using two-age management in aspen-birch for cubic-foot production are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the cubic-foot production goal in aspen-birch stands. Aspen-birch guidelines are as follows:

- Stands should be a minimum of 10 acres.
- Use a minimum rotation length of 40 years and a maximum of 70 years on better-quality sites. A rotation of 50 years is suitable for low-quality sites.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- No maintenance of the stand is required until the end of the rotation.
- At the end of the rotation, patch cut the stand when it is mature.

  Note: If the birch component is important, release birch in the sapling stage.

Group Selection could be used to achieve the cubic-foot production goal in aspen-birch stands but would not be as effective as even-age management or patch cutting. Guidelines for using "group selection" in aspen-birch stands for this goal are not available at this time.

Single-tree Selection will not achieve the cubic-foot production goal in aspen-birch stands.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in Allegheny Hardwood Stands

In this forest type, the values of sawtimber products are so high that landowners may prefer to manage for board-foot production and use the cubic-foot by-products of thinnings to meet cubic-foot objectives.

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in Allegheny hardwoods. Allegheny hardwood guidelines are as follows:

- Optimum rotation age is 60 years, with a range of 50-70 years. If the % basal area in CAPS (cherry, ash, yellow-poplar) is $\geq$ 50%, a shorter rotation is recommended, otherwise use a longer rotation.
- A minimum of 50% in acceptable growing stock (AGS) is acceptable for cubic-foot products.
- No cutting is required for the first 50 years of the rotation.

- At 50-60 years, look into a possible shelterwood cut to promote regeneration.
- At the end of the rotation, do a clearcut or a second cut in shelterwood.

Two-age Management is the "next best" silvicultural system to use to achieve the cubic-foot production goal in Allegheny hardwoods. Allegheny hardwood guidelines are as follows:

- Optimum rotation age is 60 years, with a range of 50-70 years. If the % basal area in CAPS (cherry, ash, yellow-poplar) is ≥ 50%, a shorter rotation is recommended, otherwise use a longer rotation.
- A minimum of 50% in AGS is acceptable for cubic-foot products.
- No cutting is required for the first 30 years of the rotation.
- At 30 years, harvest the 60-year-old age class, leaving 30% residual density to reduce density of younger age class to promote regeneration.
- From 30 years to the end of the rotation, no additional cutting is required.
- At the end of the rotation, harvest the older age class, retaining 30% residual density.

Patch Cutting could be used to achieve the cubic-foot production goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using "patch cutting" in Allegheny hardwoods for cubic-foot production are not available at this time.

Group Selection could be used to achieve the cubic-foot production goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using "group selection" in Allegheny hardwoods for cubic-foot production are not available at this time.

Single-tree Selection could be used to achieve the cubic-foot production goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using single-tree selection in Allegheny hardwoods for cubic-foot production are not available at this time.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in Appalachian Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in Appalachian hardwoods. Appalachian hardwood guidelines are as follows:

- Optimum rotation age is 40 years, with a minimum of 30 and a maximum of 60 years.
- A minimum of 30% of acceptable growing stock (AGS) is recommended.
- For the first 15 years, examine the stand and consider precommercial cultural practices such as removal of grapevines, timber stand improvement (TSI), and possibly selecting crop trees.
- From 15 years to the end of the rotation, consider precommercial cultural treatments.
- At the end of the rotation, harvest.

Two-age Management is considered the "next best" silvicultural system to use to achieve the cubic-foot production goal in Appalachian hardwoods. Appalachian hardwood guidelines are as follows:

- Optimum rotation age is 40 years, with a minimum of 30 and a maximum of 60 years.
- A minimum of 30% of AGS is recommended.
- For the first 15 years, examine the stand and consider precommercial cultural practices such as removal of grapevines, TSI, and possibly selecting crop trees.
- From 15 years to the end of the rotation, consider precommercial cultural treatments.
- At the end of the rotation, harvest the older age class.

Patch Cutting could be used to achieve the cubic-foot production goal in Appalachian hardwoods but would not be as effective as even age or two-age management. Guidelines for using "group selection" in Appalachian hardwoods for cubic-foot production are not available at this time.

Group Selection could be used to achieve the cubic-foot production goal in Appalachian hardwoods but would not be as effective as even age or two-age management. Guidelines for using "group selection" in Appalachian hardwoods for cubic-foot production are not available at this time.

Single-tree Selection will not achieve the cubic-foot production goal.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in Hemlock Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in hemlock hardwoods stands. Hemlock hardwood guidelines are as follows:

- A rotation age of 80 years is recommended, typically 50–60 years for hardwoods but 80 years to allow hemlock to grow.
- A minimum of 50–60 square feet per acre (i.e., about 1/2 of the B line on the stocking chart) of acceptable growing stock (AGS) is recommended.
- For the first 40 years, no cutting is required.
- From 40–50 years, thin from above, removing mainly hardwoods.
- From 50–70 years, no cutting is required.
- At 70 years, make a first shelterwood cut.
- At 80 years, make a second shelterwood cut.

Two-age Management would achieve the cubic-foot production goal in hemlock hardwoods stands but would not be as effective as even-age management. Guidelines for using two-age management in hemlock hardwoods stands for this goal are not available at this time.

Patch Cutting would achieve the cubic-foot production goal in hemlock hardwoods stands but would not be as effective as even-age management. Guidelines for using patch cutting in hemlock hardwoods stands for this goal are not available at this time.

Group Selection would achieve the cubic-foot production goal in hemlock hardwoods stands but would not be as effective as even-age management. Guidelines for using group selection in hemlock hardwoods stands for this goal are not available at this time.

Single-tree Selection would achieve the cubic-foot production goal in hemlock hardwoods stands but would not be as effective as even-age management. Guidelines for using single-tree selection in hemlock hardwoods stands for this goal are not available at this time.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in Northern Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in northern hardwoods. Northern hardwood guidelines are as follows:

- A rotation age of 50–60 years is recommended.
- For the first 50–60 years, no cutting is required.
- At the end of the rotation, do a clearcut.

Two-age Management could be used to achieve the cubic-foot production goal in northern hardwoods but would not be as effective as even-age management or patch cutting. Guidelines for using two-age management in northern hardwoods for this goal are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the cubic-foot production goal in northern hardwoods. Northern hardwood guidelines are as follows:

- Do not conduct any thinnings over the life of the rotation.
- Patches should be 5 acres.
- A rotation age of 50–60 years is recommended.
- For the first 50–60 years, no cutting is required.
- At the end of the rotation, do a patch cut.

Group Selection could be used to achieve the cubic-foot production goal in northern hardwoods but would not be as effective as even-age management or patch cutting. Guidelines for using group selection in northern hardwoods for this goal are not available at this time.

Single-tree Selection could be used to achieve the cubic-foot production goal in northern hardwoods but would not be as effective as even-age management or patch cutting. Guidelines for using single-tree selection in northern hardwoods for this goal are not available at this time.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in Oak-hickory Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in oak-hickory stands. Oak-hickory guidelines are as follows:

- A rotation age of 35-60 years is recommended, with 45 years being the average.
- A minimum of 30% in acceptable growing stock (AGS) is recommended.
- For the first 10 years, do nothing.
- From 10−20 years, examine the stand and consider precommercial practices such as grapevine removal, timber stand improvement (TSI), and possibly selecting crop trees.
- From 20 years to the end of the rotation, consider precommercial cultural treatments.
- At the end of the rotation, do a clearcut.

Two-age Management could be used to achieve the cubic-foot production goal in oak-hickory stands but would not be as effective as even-age management or patch cutting. Guidelines for using two-age management in oak-hickory stands for this goal are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the cubic-foot production goal in oak-hickory stands. Oak-hickory guidelines are as follows:

- A re-entry period of 5−15 years is recommended, with 10 years being the average.
- A rotation age of 35–60 years is recommended, with 45 years being the average.
- A minimum of 30% in AGS is recommended.

For each patch:

- At each entry, thin if needed between the patches.
- For the first 10 years, do nothing.
- From 10−20 years, examine the stand and consider precommercial practices such as grapevine removal, TSI, and possibly selecting crop trees.
- From 20 years to the end of the rotation, consider precommercial cultural treatments.
- At the end of the rotation, do a clearcut.

Group Selection could achieve the cubic-foot production goal in oak-hickory stands but would not be as effective as using even-age management or patch cutting. Guidelines for using group selection in oak-hickory stands for this goal are not available at this time.

Single-tree Selection will not regenerate the oak-hickory type. On better sites the type will change to yellow poplar and mixed hardwoods. On poorer sites the type will change to a mixture of tolerant species.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in Oak-Northern Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in oak-northern hardwoods stands. Oak-northern hardwood guidelines are as follows:

- An optimal rotation age of 50 years is recommended, or within a range of 40–60 years.
- Oaks should be a minimum of 25 feet tall for release.
- For the first 10 years, retain a minimum of 30 codominant northern red oak stems per acre—more is better. Maximize the number of red oaks.
- From 10–40 years, do precommercial thinning to the B line on the New England northern red oak stocking chart.
- A cutting period of 10 years, with a range of 8−12 years is recommended.
- At 40 years, establish oak regeneration, using non-commercial techniques as developed by Loftis (1993).
- At 50 years, conduct a first-cut shelterwood.
- At 60 years, conduct a removal-cut shelterwood.

  If you have a deer problem, there is a good chance that the understory may not be oak.

Two-age Management is considered the "next best" silvicultural system (along with patch cutting) to use to achieve the cubic-foot production goal in oak-northern hardwoods stands. Oak-northern hardwood guidelines are as follows:

- An optimal rotation age of 50 years is recommended, or within a range of 40-60 years.
- A cutting period of 25 years is recommended.
- For the first 25 years, no work is required in the younger age class.
- At 50 years, cut the older age class.

Patch Cutting is considered the "next best" silvicultural system (along with two-age management) to use to achieve the cubic-foot production goal in oak-northern hardwoods stands. Oak-northern hardwood guidelines are as follows:

- A re-entry period of 515 years is recommended, with 10 years being the average.
- A rotation age of 40–60 years is recommended, with 50 years being the average.
- A minimum of 30% in acceptable growing stock (AGS) in oak is recommended.

For each patch:

- At each entry, thin if needed between the patches.
- For the first 10 years, do nothing.
- From 10−20 years, examine the stand and consider precommercial practices such as grapevine removal, timber stand improvement (TSI), and possibly selecting crop trees.

- From 20 years to the end of the rotation, consider precommercial cultural treatments.
- At the end of the rotation, do a clearcut.

  If you have a deer problem, there is a good chance that the understory may not be oak.

Group Selection should not be used to achieve the cubic-foot production goal in oak-northern hardwoods because forest type is likely to convert to northern hardwoods.

Single-tree Selection should not be used to achieve the cubic-foot production goal in oak-northern hardwoods because forest type is likely to convert to northern hardwoods.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in Spruce-Fir Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in spruce-fir stands. Spruce-fir guidelines are as follows:

- A rotation age of 50–60 years is recommended.
- For the first 30 years, no work is required.
- At approximately 35 years, when the basal area is 120−140 square feet per acre, thin back to 80−100 square feet per acre.
- From 36–50 years, no work is required.
- From 50–60 years, do a first cut shelterwood not to exceed 35–40% removal.
- From 58–72 years, or about 8−12 years after the first cut in shelterwood, remove the overstory when seedlings reach a minimum of 2–4 feet.

Two-age Management could be used to achieve the cubic-foot production goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using two-age management in spruce-fir stands for this goal are not available at this time.

Patch Cutting could be used to achieve the cubic-foot production goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using patch cutting in spruce-fir stands for this goal are not available at this time.

Group Selection is considered the "next best" silvicultural system to use to achieve the cubic-foot production goal in spruce-fir stands. Spruce-fir guidelines are as follows:

- The desired q factor is 2.0−2.2.
- Maximum diameter to be retained is 16 inches dbh.
- A cutting cycle of 10−15 years is recommended or when the basal area reaches 130−135 square feet per acre cut it back to 90−100 square feet.

Single-tree Selection could be used to achieve the cubic-foot production goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using single-tree selection in spruce-fir stands for this goal are not available at this time.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in Spruce-Hardwood Stands

Even-age Management is considered the "next best" silvicultural system to use to achieve the cubic-foot production goal in spruce-hardwoods stands if the softwoods in the stand are taller. Spruce hardwood guidelines are as follows:

- A rotation age of 60 years is recommended.
- For the first 30 years, no work is required.
- From 30−35 years, thin the stand, such that when the basal area of trees ≥5 inches diameter ar breast height (dbh) reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low quality trees to improve stand quality.
- From 35-60 years, no work is required.
- At 60 years, begin a two-cut shelterwood sequence.

Two-age Management could achieve the cubic-foot production goal in spruce-hardwoods stands but would not be as effective as using even-age management, group selection or single-tree selection. Guidelines for using two-age management in spruce-hardwoods stands to achieve this goal are not available at this time.

Patch Cutting could achieve the cubic-foot production goal in spruce-hardwoods stands but would not be as effective as using even-age management, group selection or single-tree selection. Guidelines for using patch cutting in spruce-hardwoods stands to achieve this goal are not available at this time.

Group Selection is considered the "best" silvicultural system to use to achieve the cubic-foot production goal in spruce-hardwoods stands. Spruce-hardwood guidelines are as follows:

- A maximum of 0.25 acre group size is recommended.
- A q factor of 1.5−1.9 is recommended, and 1.7 is optimal.
- Maximum diameter to be retained is 18 inches dbh.
- A cutting cycle of 15−20 years is recommended, with 20 years the maximum.
- When the basal area of trees ≥5 inches dbh reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- When the basal are reaches 120−140 square feet, cut back to a basal area of 80−100 square feet.

Single-tree Selection is considered the "next best" silvicultural system to use to achieve the cubic-foot production goal in spruce-hardwoods stands if the hardwoods in the stand are taller. Spruce hardwood guidelines are as follows:

- A q factor of 1.5−1.9 is recommended, and 1.7 is optimal.
- Maximum diameter to be retained is 18 inches dbh.
- A cutting cycle of 15−20 years is recommended, with 20 years the maximum.
- When the basal area of trees ≥5 inches dbh reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- When the basal are reaches 120−140 square feet, cut back to a basal area of 80−100 square feet.

No Cutting will not achieve the cubic-foot production goal.

Silvicultural Guidelines for Cubic-foot Production in White Pine Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the cubic-foot goal in white pine stands. White pine guidelines are as follows:

- A rotation age of 40–70 years is appropriate, and 60 is optimal.
- A minimum growing stock of 65 square feet per acre of trees ≥ 5 inches is recommended.
- For the first 60 years or until the end of the rotation, no work is required.
- At the end of the rotation, begin a two-cut shelterwood sequence. In the first cut, ensure that stocking remains at or above the B line of the white pine stocking chart. Perform the second cut when regeneration is adequate on at least 35% of the plots—60-65% is preferred.

Two-age Management could achieve the cubic-foot production goal in white pine stands but would not be as effective as using even-age management or group selection. Guidelines for using two-age management in white pine stands for this goal are not available at this time.

Patch Cutting could achieve the cubic-foot production goal in white pine stands but would not be as effective as using even-age management or group selection. Guidelines for using patch cutting in white pine stands for this goal are not available at this time.

Group Selection is considered the "next best" silvicultural system to use to achieve the cubic-foot production goal in white pine stands. White pine guidelines are as follows:

- A q factor of 1.3, 1.5, or 1.8 is recommended.
- Maximum diameter to be retained is 24 inches diameter at breast height (dbh).
- A cutting cycle of 10–40 years is recommended, with 10−20 years optimal.
- Group size should be equivalent to 1/2−1 full tree height across.
- Make groups where regeneration already exists.

Single-tree Selection will not achieve the cubic-foot production goal in white pine stands.

No Cutting will not achieve the cubic-foot production goal.

Periodic Income

Silvicultural Guidelines for Periodic Income in Aspen-Birch Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the periodic income goal in aspen-birch stands. Aspen birch guidelines depend on the aspen site index.

If aspen site index is at least 60:

- Stands should be a minimum of 10 acres.
- A rotation length of 50-90 years is appropriate.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- Prior to the end of the rotation, when the basal area reaches 120−140 square feet per acre, thin once back to 60-70 square feet per acre.
- At the end of the rotation, clearcut the stand when it is mature.

  Note: If the birch component is important, release birch in the sapling stage.

If aspen site index is less than 60:

- Stands should be a minimum of 10 acres.
- Use a minimum rotation length of 40 years and a maximum of 70 years on better-quality sites. A rotation of 50 years is suitable for low-quality sites.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- No maintenance of the stand is required until the end of the rotation.
- At the end of the rotation, clearcut the stand when it is mature.

  Note: If the birch component is important, release birch in the sapling stage.

Two-age Management could be used to achieve the periodic income goal in aspen-birch stands but would not be as effective as even-age management or patch cutting. Guidelines for using two-age management in aspen birch for this goal are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the periodic income goal in aspen-birch stands. Aspen birch guidelines depend on the aspen site index.

If aspen site index is at least 60:

- Stands should be a minimum of 10 acres.
- A minimum of 60 square feet per acre in basal area of acceptable growing stock (AGS) is recommended.
- A rotation length of 50–90 years is appropriate.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.

- Prior to the end of the rotation, when the basal area reaches 120-140 square feet per acre, thin once back to 60–70 square feet per acre.
- At the end of the rotation, do a patch cut when the stand is mature.

Note: If the birch component is important, release birch in the sapling stage.

If aspen site index is less than 60:

- Stands should be a minimum of 10 acres.
- Use a minimum rotation length of 40 years and a maximum of 70 years on better-quality sites. A rotation of 50 years is suitable for low-quality sites.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- No maintenance of the stand is required until the end of the rotation.
- At the end of the rotation, do a patch cut when the stand is mature.

Note: If the birch component is important, release birch in the sapling stage.

Group Selection could be used to achieve the periodic income goal in aspen-birch stands but would not be as effective as even-age management or patch cutting. Guidelines for using group selection in aspen-birch stands for this goal are not available at this time.

Single-tree Selection will not achieve the periodic income goal in aspen-birch stands.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in Allegheny Hardwood Stands

Even-age Management is the "best" silvicultural system to use to achieve the periodic income goal in Allegheny hardwoods. Allegheny hardwood guidelines are as follows:

- Optimum rotation age is 90 years, with a range of 80−110 years. If the % basal area in CAPS (cherry, ash, yellow-poplar) is ≥ 50%, a shorter rotation is recommended, otherwise use a longer rotation.
- A minimum of 30% in acceptable growing stock (AGS) is acceptable.
- No cutting is required for the first 45 years of the rotation.
- At 45–70 years (60 years is optimum), perform a first commercial thinning predominantly from below to a residual density of 60%.
- From 60–85 years (15 years after the first thinning) perform a second commercial thinning predominantly from below to a residual density of 60%.
- From 70–95 years (10 years after the second thinning) examine the advance regeneration and do a first cut in a shelterwood sequence if necessary.
- At the end of the rotation (15 years after the second thinning), do a second cut of a shelterwood sequence or a clearcut. A deferment cut is acceptable if clearcutting is not allowed, retaining up to 10 square feet per acre of basal area.

Two-age Management is the "next best" silvicultural system to use to achieve the periodic income goal in Allegheny hardwoods. Allegheny hardwood guidelines are as follows:

- Optimum rotation age is 90 years, with a range of 80−110 years. If the % basal area in CAPS (cherry, ash, yellow-poplar) is ≥ 50%, a shorter rotation is recommended, otherwise use a longer rotation.
- A minimum of 30% in AGS is acceptable.
- For the first 45 years, no work is required. Depending on stocking level, a thinning at 35 years may be necessary.
- At 45 years, harvest the older age class, leaving a 30% residual density.
- From 45–90 years, no work is required. Depending on stocking, however, thinning every 8 years may be necessary.
- At the end of the rotation, harvest the older age class, leaving a 30% residual density.

Patch Cutting could be used to achieve the periodic income goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using patch cutting in Allegheny hardwoods for periodic income are not available at this time.

Group Selection could be used to achieve the periodic income goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using group selection in Allegheny hardwoods for periodic income are not available at this time.

Single-tree Selection could be used to achieve the periodic income goal in Allegheny hardwoods but would not be as effective as even age or two-age management. Guidelines for using single-tree selection in Allegheny hardwoods for periodic income are not available at this time.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in Appalachian Hardwood Stands

Even-age Management could be used to achieve the periodic income goal in Appalachian hardwoods but would not be as effective as patch cutting or group selection. Guidelines for using even-age management in Appalachian hardwoods for periodic income are not available at this time.

Two-age Management could be used to achieve the periodic income goal in Appalachian hardwoods but would not be as effective as patch cutting or group selection. Guidelines for using two-age management in Appalachian hardwoods for periodic income are not available at this time.

Patch Cutting is considered the "best" silvicultural system to use to achieve the periodic income goal in Appalachian hardwoods. Appalachian hardwood guidelines are as follows:

- A re-entry period of 5−20 years is recommended, with 10 years being optimal.
- A rotation age of 60−100 years is recommended, with 80 years being optimal.
- A minimum of 30% in acceptable growing stock (AGS) is recommended.

For each patch:

- For the first 15 years, examine the stand and consider precommercial practices such as grapevine removal, timber stand improvement (TSI), and possibly selecting crop trees.
- From 15-40 years, consider precommercial treatments at each cutting harvest cycle.
- From 40-60 years, thin as necessary.
- From 70+ years or at the end of the rotation, cut the patch.

Group Selection is considered the "next best" silvicultural system to use to achieve the periodic income goal in Appalachian hardwoods. Openings should be 1/2 acre in size or larger. Appalachian hardwood guidelines are as follows:

- The desired q factor is 1.1−1.5, with 1.3 optimal.
- Maximum diameter to be retained is 20−32 inches diameter at breast height (dbh), with 26 inches optimal.
- A cutting cycle of 5−20 years is recommended (10 is optimal).

Single-tree Selection will not achieve the periodic income goal.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in Hemlock Hardwood Stands

Even-age Management is the "best" silvicultural system to use to achieve the periodic income goal in hemlock hardwoods stands if the stand is currently in an even age structure. Hemlock hardwood guidelines are as follows:

- A rotation age of 80−120 years is recommended.
- A minimum of 50–60 square feet per acre of acceptable growing stock (AGS) is recommended.
- For the first 50 years, no cutting is required.
- At 50 years, thin to the B line on the Tubbs (1977) stocking guide.
- From 50–65 years, no cutting is required.
- From 65–70 thin to the B line on the Tubbs (1977) stocking guide.
- If a shorter rotation is being used, from 70-80 years no cutting is required. At 80 years, do a first cut in a shelterwood sequence.
- If a longer rotation is being used, from 70-90 years thin to the B line on the Tubbs (1977) stocking guide. From 90−110 years do a first cut in a shelterwood sequence.

Two-age Management could be used to achieve the periodic income goal in hemlock hardwoods stands but would not be as effective as even-age management or group selection. Guidelines for using two-age management in hemlock hardwoods stands to achieve this goal are not available at this time.

Patch Cutting could be used to achieve the periodic income goal in hemlock hardwoods stands but would not be as effective as even-age management or group selection. Guidelines for using patch cutting in hemlock hardwoods stands to achieve this goal are not available at this time.

Group Selection is the "best" silvicultural system to use to achieve the periodic income goal in hemlock hardwoods stands if the stand is currently in an uneven age structure. Hemlock hardwood guidelines are as follows:

- A cutting cycle of 15 years is optimum but earlier if necessary to establish structure.
- The maximum diameter to retain for hemlock is 18 inches because of shake problems, and a maximum diameter of 22 inches is recommended for hardwoods.
- When the stand basal area reaches 150−180 square feet per acre, cut back to 130 square feet per acre or within a range of 120−150 square feet per acre for pure hemlock stands.

Single-tree Selection could be used to achieve the periodic income goal in hemlock hardwoods stands but would not be as effective as even-age management or group selection. Guidelines for using single-tree selection in hemlock hardwoods stands to achieve this goal are not available at this time.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in Northern Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the periodic income goal in northern hardwoods if the stand is currently in an even-age structure. Northern hardwood guidelines are as follows:

- A rotation age of 120 is recommended.
- For the first 60 years, no cutting is required.
- From 60–70 years, conduct a first thinning to the B line on the stocking chart.
- From 70–90 years, an optional second thinning may be done.
- At the end of the rotation, harvest the stand with a clearcut if the site allows.

Two-age Management could achieve the periodic income goal in northern hardwoods but would not be as effective as using even-age management, group selection or patch cutting. Guidelines for using two-age management in northern hardwoods for this goal are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the periodic income goal in northern hardwoods. Northern hardwood guidelines are as follows:

- Patches should be small to give a better mix of species.
- A rotation age of 120 years is recommended, whereas one-sixth of the stand is cut in patches every 20 years.
- For the first 60 years, no cutting is required.
- From 60–70 years, conduct a first thinning.
- From 70–90 years, conduct an optional second thinning.
- At 120 years or at the end of the rotation, complete a patch cut. The overall residual, including both groups and areas between groups, should target 70-75 square feet per acre. Individual trees between groups may be cut as needed.

Group Selection is considered the "best" silvicultural system to use to achieve the periodic income goal in northern hardwoods if the stand is currently in an uneven-age structure. Northern hardwood guidelines are as follows:

- The maximum diameter to retain is 24 inches.
- A q factor of 1.1−1.5 is recommended (1.3 is optimum).
- A cutting cycle of 15−20 years is appropriate.
- If the basal area is less than 100 square feet per acre, no cutting is required.
- If the basal area is at least 100 square feet per acre, conduct group selection to a basal area of 70–75 square feet per acre among groups.

Single-tree Selection could achieve the periodic income goal in northern hardwoods but would not be as effective as using even-age management, group selection or patch cutting. Guidelines for using two-age management in northern hardwoods for this goal are not available at this time.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in Oak-Hickory Stands

Even-age Management could be used to achieve the periodic income goal in oak-hickory stands but would not be as effective as using patch cutting or group selection. Guidelines for using even-age management in oak-hickory stands for this goal are not available at this time.

Two-age Management could be used to achieve the periodic income goal in oak-hickory stands but would not be as effective as using patch cutting or group selection. Guidelines for using two-age management in oak-hickory stands for this goal are not available at this time.

Patch Cutting is considered the "best" silvicultural system to use to achieve the periodic income goal in oak-hickory stands. Oak-hickory guidelines are as follows:

- A re-entry period of 5−15 years is recommended, with 10 years being optimal.
- A rotation age of 80−120 years is recommended, with 90 years being optimal.
- A minimum of 30% in acceptable growing stock (AGS) is recommended.

For each patch:

- At each entry, thin if needed between the patches.
- For the first 10 years, do nothing.
- From 10−20 years, examine the stand and consider precommercial practices such as grapevine removal, timber stand improvement (TSI), and possibly selecting crop trees.
- From 20–40 years, consider precommercial treatments.
- From 40-75 years, consider a maximum of two commercial thinnings depending on markets and rotation age.
- From 75 years to the end of the rotation, do nothing.
- At the end of the rotation, do a clearcut.

Group Selection is considered the "next best" silvicultural system to use to achieve the periodic income goal in oak-hickory stands. Oak-hickory guidelines are as follows:

- The maximum diameter to retain is 16-30 inches diameter at breast height (dbh) (average is 24 inches dbh).
- A q factor of 1.1−1.5 is recommended (1.3 is optimum).
- A cutting cycle of 5−25 years is appropriate (average is 15 years).

Single-tree Selection will not regenerate the oak-hickory type. On better sites the type will change to yellow-poplar and mixed hardwoods. On poorer sites the type will change to a mixture of tolerant species.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in Oak-Northern Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the periodic income goal in oak-northern hardwoods stands. Oak-northern hardwoods guidelines are as follows:

- Oaks should be a minimum of 25 feet tall for release.
- Conduct precommercial thinnings until age 40–50 years.
- An optimal rotation age of 100 years is recommended, or within a range of 80−120 years.
- A cutting period of 10 years, with a range of 8−12 years is recommended.
- For the first 10 years, retain a minimum of 30 codominant northern red oak stems per acre—more is better. Maximize the number of red oaks.
- From 10–40 years, do precommercial thinning to the B line on the New England northern red oak stocking chart.
- From 40–70 years, do commercial thinning to the B line.
- At 70 years, establish oak regeneration, using non-commercial techniques as developed by Loftis (1993).
- At 80 years, conduct a first-cut shelterwood.
- At 100 years, conduct a removal-cut shelterwood.

  If you have a deer problem, there is a good chance that the understory may not be oak.

Two-age Management is considered the "next best" silvicultural system (along with patch cutting) to use to achieve the periodic income goal in oak-northern hardwoods stands. Oak-northern hardwoods guidelines are as follows:

- An optimal rotation age of 100 years is recommended.
- A cutting period of 50 years is recommended.
- For the first 50 years, no work is required in the younger age class.
- From 50−100 years, cut the older age class.

Patch Cutting is considered the "next best" silvicultural system (along with two-age management) to use to achieve the periodic income goal in oak-northern hardwoods stands. Oak-northern hardwoods guidelines are as follows:

- Oaks should be a minimum of 25 feet tall for release.
- Conduct precommercial thinnings until age 40–50 years.
- An optimal rotation age of 100 years is recommended, or within a range of 80−120 years.
- A cutting period of 10 years, with a range of 8−12 years is recommended.
- For the first 10 years, retain a minimum of 30 codominant northern red oak stems per acre—more is better. Maximize the number of red oaks.
- From 10–40 years, do precommercial thinning to the B line on the New England northern red oak stocking chart.
- From 40–70 years, do commercial thinning to the B line.
- At 70 years, establish oak regeneration, using non-commercial techniques as developed by Loftis (1993).
- At 80 years, conduct a first-cut shelterwood.
- At 100 years, conduct a removal-cut shelterwood.

  If you a have deer problem, there is a good chance that the understory may not be oak.

Group Selection should not be used to achieve the periodic income goal in oak-northern hardwoods because forest type is likely to convert to northern hardwoods.

Single-tree Selection should not be used to achieve the periodic income goal in oak-northern hardwoods because forest type is likely to convert to northern hardwoods.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in Spruce-Fir Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the periodic income goal in spruce-fir stands if the stand is currently in an even-age structure. Spruce-fir guidelines are as follows:

- A rotation age of 80–90 years is recommended.
- For the first 9 years, no work is required.
- From 9−11 years, do a precommercial thinning when tree height is 6−10 feet if stocking ≥ 40% and there are at least 3,000 stems/acre.
- From 11−35 years, no work is required.
- At approximately 35 years, when the basal area is 120−140 square feet per acre, do a first commercial thinning back to 80−100 square feet per acre—no lower than the B line on the stocking chart.
- From 36–60 years, no work is required.
- From 60–65 years, do a second commercial thinning when basal area reaches 150−160 square feet per acre. Thin back to 110−120 square feet per acre.

- From 65–80 years, no work is required.
- At 80 years, begin a shelterwood sequence. Do a first cut shelterwood, removing 35% (one-third of stand). Take out unwanted trees such as the fir and leave trees you want for seed.
- After that, do a second cut in shelterwood—removing two-thirds of what is remaining. Focus on getting spruce regeneration.
- Remove the overstory when the stand is adequately stocked (i.e., greater than 40-50% stocking of desirable seedlings). **Note**: If you have a hardwood problem you need to make sure softwood seedlings are 2-4 feet before removing the overstory in the third shelterwood cut.

Two-age Management could achieve the periodic income goal in spruce-fir stands but would not be as effective as using even-age management, group selection or patch cutting. Guidelines for using two-age management are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the periodic income goal in spruce-fir stands. Spruce-fir guidelines are as follows:

- A rotation age of 80–90 years is recommended.
- For the first 9 years, no work is required.
- From 9−11 years, do a precommercial thinning when tree height is 6−10 feet if stocking ≥ 40% and there are at least 3,000 stems/acre.
- From 11−35 years, no work is required.
- At approximately 35 years, when the basal area is 120−140 square feet per acre, do a first commercial thinning back to 80−100 square feet per acre—no lower than the B line on the stocking chart.
- From 36–60 years, no work is required.
- From 60–65 years, do a second commercial thinning when basal area reaches 150−160 square feet per acre. Thin back to 110−120 square feet per acre.
- From 65–80 years, no work is required.
- At the end of the rotation, or about 80-90 years, do a patch cut.

Group Selection is considered the "best" silvicultural system to use to achieve the periodic income goal in spruce-fir stands if the stand is currently in an uneven-age structure. Spruce-fir guidelines are as follows:

- The desired q factor is 1.7−2.0.
- Maximum diameter to be retained is 20 inches diameter at breast height (dbh).
- A cutting cycle of 15−20 years is recommended or when the basal area reaches 130−135 square feet per acre cut it back to 80-90 square feet. Thin within groups when tree height is 6−12 feet in order to favor spruce.

Single-tree Selection could achieve the periodic income goal in spruce-fir stands but would not be as effective as using even-age management, patch cutting or group selection. Guidelines for using single-tree selection in spruce-fir stands to achieve this goal are not available at this time.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in Spruce-Hardwood Stands

Even-age Management is considered the "next best" silvicultural system to use to achieve the periodic income goal in spruce-hardwoods stands (along with patch cutting) if the softwoods are taller than the hardwoods. Spruce-hardwood guidelines are as follows:

- A rotation age of 100 years is recommended.
- For the first 40 years, no work is required.
- From 40–50 years, thin the stand, such that when the basal area of trees ≥5 inches diameter at breast height (dbh) reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- From 50–60 years, no work is required.
- From 60–70 years, do a second thinning when the basal area reaches 100−120 square feet per acre, cut it back down to 80 square feet and take out paper birch to release spruce.
- From 70–80 years, no work is required.
- From 80–90 years, do a third thinning when the basal area reaches 100−120 square feet per acre, cut it back down to 80 square feet.
- From 90−100 years, no work is required.
- At 100 years, begin a three-cut shelterwood sequence.

Two-age Management could achieve the periodic income goal in spruce-hardwoods stands but would not be as effective as using group selection, even-age management, patch cutting or single-tree selection. Guidelines for using two-age management in spruce hardwoods stands for this goal are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the periodic income goal in spruce-hardwoods stands (along with even-age management) if the softwoods are taller than the hardwoods. Spruce hardwood guidelines are as follows:

- Keep patches between 1−2 acres in size in order to retain the softwood component.
- A rotation age of 120 years is recommended.
- A cutting cycle of 15−20 years is recommended.
- For the first 40 years, no work is required.
- From 40–50 years, thin the stand, such that when the basal area of trees ≥5 inches dbh reaches 100–120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- From 50–60 years, no work is required.
- From 60–70 years, do a second thinning when the basal area reaches 100−120 square feet per acre, cut it back down to 80 square feet and take out paper birch to release spruce.
- From 70–80 years, no work is required.
- From 80-90 years, do a third thinning when the basal area reaches 100−120 square feet per acre, cut it back down to 80 square feet.

- From 90−100 years, no work is required.
- At 100 years, begin a three-cut shelterwood sequence.

Group Selection is considered the "best" silvicultural system to use to achieve the periodic income goal in spruce-hardwoods stands. Spruce hardwood guidelines are as follows:

- A q factor of 1.4−1.8 is recommended, and 1.6 is optimal.
- Maximum diameter to be retained is 22 inches dbh.
- A cutting cycle of 15−20 years is recommended.
- When the basal area of trees ≥5 inches dbh reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- When the basal are reaches 120−140 square feet, cut back to a basal area of 80−100 square feet.

Single-tree Selection is considered the "next best" silvicultural system to use to achieve the periodic income goal in spruce-hardwoods stands if the hardwoods are taller than the softwoods. Use single-tree selection if you have late successional species. Spruce hardwood guidelines are as follows:

- A q factor of 1.4−1.8 is recommended, and 1.6 is optimal.
- Maximum diameter to be retained is 22 inches dbh.
- A cutting cycle of 15−20 years is recommended.
- When the basal area of trees ≥5" dbh reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- When the basal are reaches 120−140 square feet, cut back to a basal area of 80−100 square feet.

No Cutting will not achieve the periodic income goal.

Silvicultural Guidelines for Periodic Income in White Pine Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the periodic income goal in white pine stands. White pine guidelines are as follows:

- A rotation age of 90 years (+/- 30) is appropriate, and 80−100 years is optimal.
- For the first 40 years, examine stand conditions to see if a cleaning is warranted.
- At 40 years, until 20 years before the rotation age, conduct a thinning when stocking reaches the midpoint between the A and B lines on the stocking chart. Thin back to the B line. Continue thinning in this manner until 20 years prior to the end of the rotation.
- At the end of the rotation, begin a two-cut shelterwood sequence because of potential white pine weevil problems.

Two-age Management could be used to achieve the periodic income goal in white pine stands but would not be as effective as using even-age management or group selection. Guidelines for using two-age management in white pine stands for this goal are not available at this time.

Patch Cutting could be used to achieve the periodic income goal in white pine stands but would not be as effective as using even-age management or group selection. Guidelines for using two-age management in white pine stands for this goal are not available at this time.

Group Selection is considered the "next best" silvicultural system to use to achieve the periodic income goal in white pine stands. White pine guidelines are as follows:

- A q factor of 1.3−1.8 is appropriate, and 1.5 is optimal.
- Maximum diameter to be retained is 30 inches diameter at breast height (dbh).
- A cutting cycle of 10–40 years is recommended, with 10−20 years optimal.
- Group size should be equivalent to 1/2−1 full tree height across.
- Make groups where regeneration already exists.

Single-tree Selection will not achieve the periodic income goal in white pine stands.

No Cutting will not achieve the periodic income goal.

Net Present Value

Silvicultural Guidelines for Maximizing Net Present Value in Aspen-Birch Stands

Even-age Management is considered the "best" silvicultural system for achieving the net present value goal in aspen-birch stands. Aspen-birch guidelines depend on the aspen site index.

If aspen site index is at least 60:

- Stands should be a minimum of 10 acres.
- A rotation length of 50-90 years is appropriate.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- Prior to the end of the rotation, when the basal area reaches 120−140 square feet per acre, thin once back to 60–70 square feet per acre.
- At the end of the rotation, clearcut the stand when it is mature.

  Note: If the birch component is important, release birch in the sapling stage.

If aspen site index is less than 60:

- Stands should be a minimum of 10 acres.
- A minimum rotation length of 40 years and a maximum of 70 years on better quality sites. A rotation of 50 years is suitable for low-quality sites.

- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- No maintenance of the stand is required until the end of the rotation.
- At the end of the rotation, clearcut the stand when it is mature.

  Note: If the birch component is important, release birch in the sapling stage.

Two-age Management could be used to achieve the net present value goal in aspen-birch stands but would not be as effective as even-age management or patch cutting. Guidelines for using two-age management in aspen-birch stands are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the net present value goal in aspen-birch stands. Aspen birch guidelines depend on the aspen site index.

If aspen site index is at least 60:

- Stands should be a minimum of 10 acres.
- A minimum of 60 square feet per acre in basal area of acceptable growing stock (AGS) is recommended.
- A rotation length of 50–90 years is appropriate.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- Prior to the end of the rotation, when the basal area reaches 120−140 square feet per acre, thin once back to 60–70 square feet per acre.
- At the end of the rotation, do a patch cut when the stand is mature.

  Note: If the birch component is important, release birch in the sapling stage.

If aspen site index is less than 60:

- Stands should be a minimum of 10 acres.
- A minimum rotation length of 40 years and a maximum of 70 years on better-quality sites. A rotation of 50 years is suitable for low-quality sites.
- Age classes and cutting cycle depend on the size of the property and how often the user is willing to go in and treat stands.
- No maintenance of the stand is required until the end of the rotation.
- At the end of the rotation, do a patch cut when the stand is mature.

  Note: If the birch component is important, release birch in the sapling stage.

Group Selection could be used to achieve the net present value goal in aspen-birch stands but would not be as effective as using even-age management or patch cutting. Guidelines for using group selection in aspen-birch stands are not available at this time.

Single-tree Selection will not achieve the net present value goal in aspen-birch stands.

No Cutting will not achieve the net present value goal.

Silvicultural Guidelines for Maximizing Net Present Value in Allegheny Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the net present value goal in Allegheny hardwoods. Allegheny hardwood guidelines are as follows:

- Optimum rotation age is 80 years, with a range of 70-90 years. If the % basal area in CAPS (cherry, ash, yellow-poplar) is ≥ 50%, a shorter rotation is recommended, otherwise use a longer rotation.
- A minimum of 30% in acceptable growing stock (AGS) is acceptable.
- No cutting is required for the first 45 years of the rotation.
- At 45–60 years—50 years is optimum, perform a first thinning to a residual density of 50%. Wait for sapling density to fall below 20 square feet per acre.
- From 60–75 years (15 years after the first thinning) perform a second commercial thinning.
- From 75–85 years (10 years after the second thinning) examine the advance regeneration and do a first cut in a shelterwood sequence if necessary.
- At the end of the rotation (15 years after the second thinning), do a second cut of a shelterwood sequence or a clearcut.

Two-age Management could be used to achieve the net present value goal in Allegheny hardwoods but would not be as effective as even-age management. Guidelines for using two-age management in Allegheny hardwoods for net present value are not available at this time.

Patch Cutting could be used to achieve the net present value goal in Allegheny hardwoods but would not be as effective as even-age management. Guidelines for using patch cutting in Allegheny hardwoods for net present value are not available at this time.

Group Selection could be used to achieve the net present value goal in Allegheny hardwoods but would not be as effective as even-age or two-age management. Guidelines for using group selection in Allegheny hardwoods for net present value are not available at this time.

Single-tree Management could be used to achieve the net present value goal in Allegheny hardwoods but would not be as effective as even-age or two-age management. Guidelines for using single-tree selection in Allegheny hardwoods for net present value are not available at this time.

No Cutting will not achieve the net present value goal.

Silvicultural Guidelines for Maximizing Net Present Value in Appalachian Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the net present value goal in Appalachian hardwoods. Appalachian hardwood guidelines are as follows:

- Optimum rotation age is 80 years, with a minimum of 70 and a maximum of 120 years.
- A minimum of 30% of acceptable growing stock (AGS) is recommended.
- For the first 15 years, examine the stand and consider precommercial cultural practices such as removal of grapevines, timber stand improvement (TSI), and possibly selecting crop trees.

- From 15–40 years, consider precommercial cultural treatments.
- From 40–65 years, consider a maximum of two commercial thinnings depending on markets and rotation age.
- From 70−120 years, harvest.

  Note: Grow stands to maximum size diameter at breast height (dbh) of 20−22 inches (sawtimber trees). Stand would average about 16 inches dbh for sawtimber trees.

Two-age Management is considered the "next best" silvicultural system to use to achieve the net present value goal in Appalachian hardwoods. Appalachian hardwood guidelines are as follows:

- Optimum rotation age is 80 years, with a minimum of 70 and a maximum of 160 years.
- A minimum of 30% of AGS is recommended.
- For the first 15 years, examine the stand and consider precommercial cultural practices such as removal of grapevines, TSI, and possibly selecting crop trees.
- From 15 years to the end of the rotation, consider precommercial cultural treatments.
- At the end of the rotation, cut the older age class.

  Note: Grow stands to maximum size dbh of 20−22 inches (sawtimber trees). Stand would average about 16 inches dbh for sawtimber trees.

Patch Cutting could be used to achieve the net present value goal in Appalachian hardwoods but would not be as effective as even-age or two-age management. Guidelines for using "patch cutting" in Appalachian hardwoods for net present value are not available at this time.

Group Selection could be used to achieve the net present value goal in Appalachian hardwoods but would not be as effective as even-age or two-age management. If group selection is used, openings should be 1/2 acre in size or larger. Guidelines for using "group selection" in Appalachian hardwoods for net present value are not available at this time.

Single-tree Selection will not achieve the net present value goal in Appalachian hardwoods.

No Cutting will not achieve the net present value goal in Appalachian hardwoods.

Silvicultural Guidelines for Maximizing Net Present Value in Hemlock Hardwood Stands

Even-age Management is the "best" silvicultural system to use to achieve the net present value goal in hemlock hardwood stands. Hemlock hardwood guidelines are as follows:

- A rotation age of 70−100 years is recommended.
- A minimum of 50 crop trees/acre is recommended.
- For the first 20 years, no cutting is required.
- From 20−30 years, thin to the B line on the Tubbs (1977) stocking guide.
- From 30–50 years, no cutting is required.

- From 50–70 years, thin to the B line on the Tubbs (1977) stocking guide.
- From 70−100 years, do a two-cut shelterwood sequence to regenerate hardwoods and hemlock.

Two-age Management could be used to achieve the net present value goal in hemlock hardwoods stands but would not be as effective as using even-age management. Guidelines for using two-age management in hemlock hardwoods sands for this goal are not available at this time.

Patch Cutting could be used to achieve the net present value goal in hemlock hardwoods stands but would not be as effective as using even-age management. Guidelines for using patch cutting in hemlock hardwoods sands for this goal are not available at this time.

Group Selection could be used to achieve the net present value goal in hemlock hardwoods stands but would not be as effective as using even-age management. Guidelines for using group selection in hemlock hardwoods sands for this goal are not available at this time.

Single-tree Selection could be used to achieve the net present value goal in hemlock hardwoods stands but would not be as effective as using even-age management. Guidelines for using single-tree selection in hemlock hardwoods sands for this goal are not available at this time.

No Cutting will not achieve the net present value goal.

Silvicultural Guidelines for Maximizing Net Present Value in Northern Hardwood Stands

Even-age Management is considered the “next best” (along with single-tree selection) silvicultural system to use to achieve the net present value goal in northern hardwoods. Northern hardwood guidelines are as follows:

- A rotation age of 120 is recommended.
- For the first 60 years, no cutting is required.
- From 60–70 years, conduct a first thinning.
- From 70–90 years, an optional second thinning may be done.
- At the end of the rotation, harvest the stand with a clearcut if the site allows. In Vermont, a shelterwood sequence may be desirable.

Two-age Management could achieve the net present value goal in northern hardwoods but would not be as effective as group selection, single-tree selection or even-age management. Guidelines for using two-age management in northern hardwoods for this goal are not available at this time.

Patch Cutting could achieve the net present value goal in northern hardwoods but would not be as effective as group selection, single-tree selection or even-age management. Guidelines for using patch cutting in northern hardwoods for this goal are not available at this time.

Group Selection is considered the “best” silvicultural system to use to achieve the net present value goal in northern hardwoods. Northern hardwood guidelines are as follows:

- The maximum diameter to retain is 22 inches.
- A q factor of 1.3−1.6 is recommended.
- A cutting cycle of 15−20 years is appropriate.
- For trees over 5 inches diameter at breast height (dbh), if the basal area is less than 100 square feet per acre, no cutting is required.
- Otherwise, if the basal area in trees 5 inches dbh and larger is at least 100 square feet per acre, conduct group selection such that the overall residual, including both groups and areas between groups, should target 70–75 square feet per acre. Individual trees between groups may be cut as needed.

Single-tree Selection is considered the "next best" silvicultural system (along with even-age management) to use to achieve the net present value goal in northern hardwoods. Northern hardwood guidelines are as follows:

- The maximum diameter to retain is 22 inches.
- A q factor of 1.3−1.6 is recommended.
- A cutting cycle of 15–20 years is appropriate.
- For trees over 5 inches dbh, if the basal area is less than 100 square feet per acre, no cutting is required.
- If the basal area of trees over 5 inches dbh is at least 100 square feet per acre, conduct single-tree selection to a basal area of 70–75 square feet per acre.

No Cutting will not achieve the net present value goal.

Silvicultural Guidelines for Maximizing Net Present Value in Oak-Hickory Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the net present value goal in oak-hickory stands. Oak-hickory guidelines are as follows:

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- A rotation age of 80−120 years is recommended, with 90 years being optimal.
- A minimum of 30% in acceptable growing stock (AGS) is recommended.
- For the first 10 years, no work is required.
- From 10−20 years, examine the stand and consider precommercial practices such as grapevine removal, timber stand improvement (TSI), and possibly selecting crop trees.
- From 20–40 years, consider precommercial cultural treatments.
- From 40–75 years, consider a maximum of two commercial thinnings depending on markets and rotation age.
- From 75 years to the end of the rotation, no work is required.
- At the end of the rotation, do a clearcut.

Two-age Management could achieve the net present value goal in oak-hickory stands but would not be as effective as using even-age management or patch cutting. Guidelines for using two-age management in oak-hickory stands for this goal are not available at this time.

Patch Cutting is considered the "next best" silvicultural system to use to achieve the net present value goal in oak-hickory stands. Oak-hickory guidelines are as follows:

- A re-entry period of 10−20 years is recommended, with 15 years being optimal.
- A rotation age of 80−120 years is recommended, with 90 years being optimal.
- A minimum of 30% in AGS is recommended.

For each patch:

- At each entry, thin if needed between the patches.
- For the first 10 years, no work is required.
- From 10−20 years, examine the stand and consider precommercial practices such as grapevine removal, TSI, and possibly selecting crop trees.
- From 20–40 years, consider precommercial treatments.
- From 40–75 years, consider a maximum of two commercial thinnings depending on markets and rotation age.
- From 75 years to the end of the rotation, no work is required.
- At the end of the rotation, do a clearcut.

Group Selection could achieve the net present value goal in oak-hickory stands but would not be as effective as using even age or patch cutting. Guidelines for using group selection in oak-hickory stands for this goal are not available at this time.

Single-tree Selection will not regenerate the oak-hickory type. On better sites the type will change to yellow poplar and mixed hardwoods. On poorer sites the type will change to a mixture of tolerant species.

No Cutting will not achieve the net present value goal.

Silvicultural Guidelines for Maximizing Net Present Value in Oak-Northern Hardwood Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the net present value goal in oak-northern hardwoods stands. Oak-northern hardwoods guidelines are as follows:

- Oaks should be a minimum of 25 feet tall for release.
- Conduct precommercial thinnings until age 40–50 years.
- An optimal rotation age of 100 years is recommended, or within a range of 80−120 years.
- A cutting period of 10 years, with a range of 8−12 years is recommended.
- For the first 10 years, retain a minimum of 30 codominant northern red oak stems per acre—more is better. Maximize the number of red oaks.
- From 10-40 years, do precommercial thinning to the B line on the New England northern red oak stocking chart.

- From 40–70 years, do commercial thinning to the B line.
- At 70 years, establish oak regeneration, using non-commercial techniques as developed by Loftis (1993).
- At 80 years, conduct a first-cut shelterwood.
- At 100 years, conduct a removal-cut shelterwood.

If you have a deer problem, there is a good chance that the understory may not be oak.

Two-age Management is considered the "next best" silvicultural system (along with patch cutting) to use to achieve the net present value goal in oak-northern hardwoods stands. Oak-northern hardwoods guidelines are as follows:

- A rotation age of 100 years is recommended.
- A cutting period of 50 years is recommended.
- For the first 50 years, no work is required in the younger age class.
- From 50−100 years, cut the older age class.

Patch Cutting is considered the "next best" silvicultural system (along with two-age management) to use to achieve the net present value goal in oak-northern hardwoods stands. Oak-northern hardwoods guidelines are as follows:

- Oaks should be a minimum of 25 feet tall for release.
- Conduct precommercial thinnings until age 40–50 years.
- An optimal rotation age of 100 years is recommended, or within a range of 80−120 years.
- A cutting period of 10 years, with a range of 8−12 years is recommended.
- For the first 10 years, retain a minimum of 30 codominant northern red oak stems/acre—more is better. Maximize the number of red oaks.
- From 10–40 years, do precommercial thinning to the B line on the New England northern red oak stocking chart.
- From 40–70 years, do commercial thinning to the B line.
- At 70 years, establish oak regeneration, using non-commercial techniques as developed by Loftis (1993).
- At 80 years, conduct a first-cut shelterwood.
- At 100 years, conduct a removal-cut shelterwood.

If you have a deer problem, there is a good chance that the understory may not be oak.

Group Selection should not be used to achieve the net present value goal in oak-northern hardwoods because forest type is likely to convert to northern hardwoods.

Single-tree Selection should not be used to achieve the net present value goal in oak-northern hardwoods because forest type is likely to convert to northern hardwoods.

No Cutting will not achieve the net present value goal.

Silvicultural Guidelines for Maximizing Net Present Value in Spruce-Fir Stands

Even-age Management is considered the "next best" silvicultural system to use to achieve the net present value goal in spruce-fir stands. Spruce-fir guidelines are as follows:

- A rotation age of 80–90 years is recommended.
- For the first 9 years, no work is required.
- From 9−11 years, do a precommercial thinning when tree height is 6−10 feet if stocking ≥ 40% and there are at least 3,000 stems per acre.
- From 11−35 years, no work is required.
- At approximately 35 years, when the basal area is 120−140 square feet per acre, do a first commercial thinning back to 80−100 square feet per acre—no lower than the B line on the stocking chart.
- From 36–60 years, no work is required.
- From 60–65 years, do a second commercial thinning when basal area reaches 150−160 square feet per acre. Thin back to 110−120 square feet per acre.
- From 65–80 years, no work is required.
- At 80 years, begin a shelterwood sequence. Do a first cut shelterwood, removing 35% (one-third of stand). Take out unwanted trees such as the fir and leave trees you want for seed.
- After that, do a second cut in shelterwood—removing two-thirds of what is remaining. Focus on getting spruce regeneration.
- Remove the overstory when the stand is adequately stocked (i.e. greater than 40-50% stocking of desirable seedlings). **Note:** If you have a hardwood problem you need to make sure softwood seedlings are 2-4 feet before removing the overstory in the third shelterwood cut.

Two-age Management could be used to achieve the net present value goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using two-age management in spruce-fir stands for this goal are not available at this time.

Patch Cutting could be used to achieve the net present value goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using patch cutting in spruce-fir stands for this goal are not available at this time.

Group Selection is considered the "best" silvicultural system to use to achieve the net present value goal in spruce-fir stands. Spruce-fir guidelines are as follows:

- The desired q factor is 1.7−2.0.
- Maximum diameter to be retained is 20 inches diameter at breast height (dbh).
- A cutting cycle of 10−15 years is recommended or when the basal area reaches 130−135 square feet per acre cut it back to 80-90 square feet.

Single-tree Selection could be used to achieve the net present value goal in spruce-fir stands but would not be as effective as using even-age management or group selection. Guidelines for using single-tree selection in spruce-fir stands for this goal are not available at this time.

No Cutting will not achieve the net present value goal.

Silvicultural Guidelines for Maximizing Net Present Value in Spruce-Hardwood Stands

Even-age Management is considered the "next best" silvicultural system to use to achieve the net present value goal in spruce-hardwood stands. Spruce-hardwood guidelines are as follows:

- A rotation age of 100 years is recommended.
- For the first 40 years, no work is required.
- From 40–50 years, thin the stand, such that when the basal area of trees ≥5 inches diameter at breast height (dbh) reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- From 50–60 years, no work is required.
- From 60–70 years, do a second thinning when the basal area reaches 100−120 square feet per acre, cut it back down to 80 square feet and take out paper birch to release spruce.
- From 70–80 years, no work is required.
- From 80–90 years, do a third thinning when the basal area reaches 100−120 square feet per acre, cut it back down to 80 square feet.
- From 90−100 years, no work is required.
- At 100 years, begin a three-cut shelterwood sequence.

Two-age Management could achieve the net present value goal in spruce-hardwoods stands but would not be as effective as using group selection or even-age management. Guidelines for using two-age management in spruce-hardwoods stands for this goal are not available at this time.

Patch Cutting could achieve the net present value goal in spruce-hardwoods stands but would not be as effective as using group selection or even-age management. Guidelines for using patch cutting in spruce-hardwoods stands for this goal are not available at this time.

Group Selection is considered the "best" silvicultural system to use to achieve the net present value goal in spruce-hardwoods stands. Spruce-hardwood guidelines are as follows:

- A q factor of 1.4−1.8 is recommended, and 1.6 is optimal.
- Maximum diameter to be retained is 22 inches dbh.
- A cutting cycle of 15–20 years is recommended.
- When the basal area of trees ≥5 inches dbh reaches 100−120 square feet per acre AND the percent basal area in sawtimber is 25−30%, an improvement cut is performed. Salvage early successional species, maintain the species composition of spruce and hardwoods, bring the diameter structure in line, and remove low-quality trees to improve stand quality.
- When the basal are reaches 120−140 square feet, cut back to a basal area of 80−100 square feet.

Single-tree Selection could achieve the net present value goal in spruce-hardwoods stands but would not be as effective as using group selection or even-age management. Guidelines for using single-tree selection in spruce-hardwoods stands for this goal are not available at this time.

No Cutting will not achieve the net present value goal.

Silvicultural Guidelines for Maximizing Net Present Value in White Pine Stands

Even-age Management is considered the "best" silvicultural system to use to achieve the net present value goal in white pine forests. White pine guidelines are as follows:

- A rotation age of 60−100 years is appropriate, and 80 years is optimal.
- For the first 40 years, examine stand conditions to see if a cleaning is warranted.
- At 40 years, until 20 years before the rotation age, conduct a thinning when stocking reaches the midpoint between the A and B lines on the stocking chart. Thin back to the B line. Continue thinning in this manner until 20 years prior to the end of the rotation.
- At the end of the rotation, begin a two-cut shelterwood sequence because of potential white pine weevil problems.

Two-age Management could achieve the net present value goal in white pine stands but would not be as effective as using even-age management or group selection. Guidelines for using two-age management in white pine stands for this goal are not available at this time.

Patch Cutting could achieve the net present value goal in white pine stands but would not be as effective as using even-age management or group selection. Guidelines for using patch cutting in white pine stands for this goal are not available at this time.

Group Selection is considered the "next best" silvicultural system to use to achieve the net present value goal in white pine stands. White pine guidelines are as follows:

- A q factor of 1.3−1.8 is appropriate, and 1.5 is optimal.
- Maximum diameter to be retained is 22 inches diameter at breast height (dbh).
- A cutting cycle of 10-40 years is recommended, with 10-20 years optimal.
- Group size should be equivalent to 1/2−1 full tree height across.
- Make groups where regeneration already exists.

Single-tree Selection will not achieve the net present value goal in white pine stands.

No Cutting will not achieve the net present value goal.

Glossary

abiotic factors—The nonliving components that make-up or interact with a community or ecosystem.

acre—A unit of measure describing surface area. One acre contains 43,560 square feet. A football field (without the end zones) is 45,000 square feet—slightly larger than an acre. The inside of a professional baseball diamond is about 1/4 of an acre.

advance regeneration—Young trees that have become established naturally in a forest before regeneration methods are applied. In other words, the regeneration is present in advance of any treatment.

aesthetics—The science or study of beauty, as well as the theory or understanding of the perception of the environment by all the senses.

age class—The trees in a stand that became established at, or about, the same time. The range of tree ages in a single-age class is usually less than 20 percent of the expected age of that class.

air pollution—The chemical compounds and emissions in the air that may damage the foliage of some trees.

association—A naturally occurring collection of plants and animals with similar needs for sunlight, warmth, moisture, shelter, and nutrients growing together. They function together to cycle energy, nutrients, and water; also called a community.

average annual income—The amount of money received over the course of a rotation divided by the number of years in that rotation; also called periodic income. For example, there is an even-age stand that will be regenerated when it is 110 years old. The sale of wood products from a thinning at 65 years yields $5,000, a thinning at 85 years yields $6,500, and a regeneration cut yields $30,000. The income from each sale is added and then the total is divided by the length of the rotation: $5,000 + 6,500 + 30,000 = $41,500; $41,500/110 years = $377.27 each year. Therefore, the average annual income would be $377.27.

average diameter—Average stand diameter; The average diameter at breast height (dbh) of stems among samples in a stand. Based on the simple average (arithmetic mean) dbh of all stems > 1 inch. Other measures of stand diameter in NED-2 include merchantable diameter, medial diameter, and quadratic mean diameter.

basal area—The area of the cross section of a tree's stem at 4.5 feet above ground, or breast height, in square feet. Basal area (BA) of a forest stand is the sum of the BAs of the individual trees in the stand. It is usually reported in square feet of BA per acre and is used as a measure of stand stocking, stand density, and stand volume.

Best Management Practices—Procedures and treatments that lessen soil erosion, sedimentation, stream warming, movement of nutrients, and visual quality during or following activities that alter the land.

biological diversity—The variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur. Also, the variety of ecological structures and functions at any one of these levels.

biotic factors—The living components of a community or ecosystem.

board-foot volume—The amount of wood products expressed as the number of boards 1 ft wide by 1 ft long and 1 inch thick that are sawn from logs.

breeding cover—The cover required by animals to successfully produce off-spring.

broad-leaved plant—A tree or shrub of the botanical group Angiospermae. This term is often applied literally to trees and shrubs with wide leaves as opposed to those with needle-like leaves.

buffer strip—An area of land that is left relatively undisturbed to lessen impacts of treatments next to it. Common examples include visual buffers used to screen the view from roads, and stream side buffers used to protect water quality.

bulk wood product—A product made of wood chips or wood fiber, as opposed to boards or lumber. Bulk wood products are most often measured in cubic feet or tons.

canopy—The continuous cover of branches and foliage formed collectively by the crowns of trees.

canopy closure—The degree of depth and closeness of branches and leaves of individual crowns to other crowns. It is expressed as a percentage of the maximum depth and closeness possible.

canopy density— The amount, compactness, and depth of branches and leaves of the crowns of trees.

catastrophic event—The occurrence of damaging agents such as insect outbreaks, drought and ice storms that appear suddenly and without warning. Events can be extensive and severe, but usually last for a short period of time.

Clean Water Act—A Federal Law passed in 1972 and since amended, designating forests and silvicultural activities such as logging as nonpoint sources of water pollution. To comply with the Act, most states have established Best Management Practices to control erosion and sedimentation, stream warming, and movement of nutrients into forest streams.

clearcutting—An even-age silvicultural technique involving the removal of all stems in the stand. Strip cutting is a form of clearcutting.

cold-water fish—Fish that are very sensitive to and intolerant of warm water. They include salmonids such as brook trout.

commercial treatment—Any activity producing forest products that have at least enough value to cover the direct costs of the activity.

conifer—Trees, mostly evergreens, bearing cones and needle-shaped or scale-like leaves.

corridors—Corridors are usually linear patches or connections between similar patches, that differ from the elements on either side. Corridors can function as habitat for some species (especially species that live in edge habitats), serve as conduits or routes of movement between patches, or act as barriers to movement across the matrix.

crop tree—Any tree selected to provide a specific benefit such as mast, dens, veneer, or sawtimber. Crop trees are usually selected when they are young.

crown—The part of a tree or woody plant bearing living branches and foliage.

cubic-foot volume—The amount of wood products expressed as the number of cubes 1 foot wide by 1 foot long and 1 foot high that are in a log or stem.

cumulative effects—An effect initiated by an event that was tied in time or space to other events (e.g., one straw broke the proverbial camel's back, but only because many straws had already been piled on). Cumulative events can be additive (e.g., straws on the camel's back) or compounded (involving more than one process). For example, increased frequencies of high flood events, debris torrents, and dam-break floods can adversely affect aquatic habitats and bury low-gradient stream reaches in debris. The occurrence of such events are not only due to severe storm conditions but to the effects of land management activities such as timber harvesting practices, road density, construction and maintenance standards, and conversion of land cover from forests to other land uses.

cutting cycle—The planned interval between treatments in forest stands.

damaging agent—Any one of various factors that injure trees. They include some insects, diseases, wildlife, abiotic factors, and human activities.

dbh—Diameter at breast height; the diameter of the trunk of a tree measured at 4.5 ft above ground level. It is measured on the uphill side of the tree.

dead and down material—Any dead branches, tree trunks, or stumps that are on the ground.

deformity—The abnormal development of a tree's shape, caused by damaging agents or too much shading. Tree trunks can be crooked or swollen, branches can be unusually forked or bent, and wood can be of inferior quality.

den tree—A living tree that has holes in the trunk, or stem, from broken branches and decay, or hollow trunks; a cavity tree.

diameter class—An interval of sizes of trees or logs; or the trees and logs themselves that fall into such an interval.

dieback—The death of branch tips and loss of foliage in the upper and outer areas of tree crowns. Trees usually recover in several years by producing new branches. Various damaging agents can cause tree crowns to die back.

disease—Any departure from the normal functioning of a plant caused by some type of persistent damaging agent.

drought—A period of dryness that is associated with low soil moisture and inability of plant roots to obtain adequate water for growth. Droughty conditions often predispose trees to other problems that also cause damage.

escape cover—The cover used to avoid a predator or other danger.

evapotranspiration—The conversion of water into water vapor which is then released into the air. The water can pass from plants (usually leaves) into the air or be evaporated from open water or the soil. Plants convert water to vapor to cool the surface of leaves.

even-age stand—A stand containing trees in the main canopy that are within 20 years of being the same age. Even-age stands sometimes are designated by age class (10-year-old stand, 40-year-old stand) or broad size-class: seedling stand (most trees are <1 inch diameter at breast height [dbh]); sapling stand (trees 1-4 inches dbh); poletimber stand (trees 5−10 inches dbh); and sawtimber stand (trees > 10 inches dbh).

even-age system—A planned sequence of treatments designed to maintain and regenerate a stand with one age class.

felling—Cutting or uprooting standing trees, causing them to fall to the ground.

fishery—A fish habitat maintained or created for sport or commercial fishing. Some examples of habitat criteria include ample food sources, favorable temperature, shelter such as woody debris and rocks, and optimal levels of dissolved oxygen and chemicals.

forest—A plant association characterized by trees and other woody vegetation, growing more or less closely together. Also, a group of stands under one ownership or manager. Forest management includes silviculture, and also involves activities such as road construction, fire protection, pest management, regulating the cut of timber products, maintenance of wildlife habitat conditions, inventory, boundary maintenance, and recreational and aesthetic planning.

forest benefit—Any of the things that you receive from a plant community dominated by trees that increase the community's value to you. These things may include beauty, solitude, biological diversity, habitats for species of special concern, water quality or quantity, wildlife, wood products, and income.

forest community—A naturally occurring collection of plants dominated by trees, and the animals associated with them, that have similar needs for sunlight, warmth, moisture, shelter, and nutrients growing together. They function together to cycle energy, nutrients, and water.

forest condition—Generally, the current characteristics of forested land including but not limited to cover type, age arrangement, stand density, understory density, canopy density, and forest health.

forest cover type—A category of forests based on the kind of trees growing there, particularly the composition of tree species. Forest cover types are often referred to as forest types, cover types, stand types, or types.

forest developmental stage—The age, condition, and degree of maturity of a forest community. For example, even-age stands develop from seedlings to saplings to poles to large diameter trees, and the community changes as the trees grow. Uneven-age stands have at least three different developmental stages in each stand.

forest health—The condition of a community of trees in relation to past, present and potential effects of damaging insects, diseases, abiotic factors, wildlife and human activities.

forest opening—An area where trees have been or will be absent from the plant community.

fungi—Organisms that reproduce by spores, and are not able to produce their own food. Fungi obtain nutrients from other living or dead organisms.

geographic range—The area, or region, where a native species occurs naturally.

groundwater—Water found in unblocked pores and fractures in bedrock and other geologic material. Groundwater can occur in soils that are permanently saturated. Groundwater may be held in place for long periods of time or move slowly down slope by gravity. Groundwater is usually obtained from wells and may contribute to streamflow by surfacing at lower elevations.

group selection—An uneven-age silvicultural technique involving the removal of trees in groups usually one-tenth to two-thirds acre in size, but sometimes up to 1 to 2 acres on large properties. Group selection can be applied in combination with single-tree selection between groups.

growth loss—A reduction in expected height and/or diameter increase. Many factors influence tree growth including available growing space, water, nutrients, amount of shading, and effects from damaging agents.

hardwoods—Woody angiosperms, broadleaf trees, that are distinguished from softwoods (gymnosperms) by the presence of vessels in the wood and broad leaves; hardwood is the wood of broad-leaved trees.

herbaceous plants—Plants with non-woody stems that normally live only one growing season. Herbaceous perennials have persisting root systems or other underground structures such as bulbs. These plants can sprout stems each growing season for several years. In forest understories, these include wildflowers and ferns.

herbicide—Any chemical preparation used to kill or inhibit the growth of certain plants, particularly herbs, or their spores or seeds. This term generally includes arboricides which are specific for trees and other woody plants.

home range—The area in which an individual animal normally confines itself to obtain food and cover.

horizontal diversity—The degree of complexity of the arrangement of plant and animal communities, and other habitats across a large area of land.

hydrologic function—The ability of vegetation, soils, and bedrock to accept rain water and snowmelt and convert it to soil water, runoff, groundwater, or evaporation. The hydrologic function in well established forest communities is excellent and provides a maximum opportunity for storing moisture and minimal overland flow.

hydrology—The study of the movement and storage of water in the natural and disturbed environment. Also, the condition of the water resource at some specified point in time.

importance value—A value that indicates the influence of a species in a community. It is computed by adding together the values for relative abundance, relative frequency, and relative dominance and dividing by three to obtain an importance percentage. Although often used, it has the disadvantage of giving similar results for species that have different combinations of the independent measures of influence.

improvement cut—A cut in an uneven-age stand, designed to upgrade the quality or species composition. No rotation age is specified for uneven-age stands. Instead, a very general maximum tree size is chosen, and residual stands after cutting are defined by maximum tree size, stand density, and stand structure—diameter distribution, proportion of sawtimber, etc.

insect— nsects associated with forests are represented by numerous species, and have a wide range of ecological roles. Most insects do not damage trees, but some do. They eat leaves, suck sap, bore through bark and wood, and introduce microorganisms that cause diseases.

interior species—Species found only or primarily away from the perimeter of a landscape element. Species commonly requiring or associated with interior habitat conditions.

intermediate cuttings—Silvicultural cuttings applied in the culture of even-age stands and are normally noncommercial (no products sold) or commercial thinnings (timber sold), designed to favor certain species, sizes, and qualities of trees by removal of competitors. Thinnings designed to grown quality timber commonly maintain a closed canopy; however, low-density thinning (50-70% residual crown cover) can be used to hasten diameter growth and stimulate understory development for wildlife purposes. At rotation age, the stand in considered to be mature, and a regeneration cutting is applied to produce a new stand.

intermediate product—Any wood product recovered from intermediate treatments.

intermediate treatment—Any treatment or "tending" designed to enhance growth, quality, vigor, and composition of the stand after seedlings are established and before mature trees are regenerated. For example, thinning is an intermediate treatment.

landing—A cleared area in the woods where logs are gathered to load onto trucks for shipment to a processing plant. Usually, it is along a road.

landscape elements—The basic, relatively homogeneous ecological elements or units, whether they are of natural or human origin. Examples include forests, rivers, fields, roads, wetlands, hedgerows, lakes, and farmyards.

leaf litter—Fallen organic matter including recognizable leaves, needles, branches, bark, and stems, that accumulate on the forest floor. Leaf litter protects the underlying organic and mineral soils against the impacts of raindrops. It prevents erosion and promotes rapid infiltration of rain and snowmelt into the soils.

logging—The felling and removal of logs and other wood products from forest stands.

lop—Cutting branches of trees that are standing, felled, or fallen.

maintenance costs—Costs that are associated with owning and caring for a piece of land. They include taxes, and upkeep of other resources such as roads.

management unit—A group of forest stands managed as a unit to provide a single package of benefits.

mast tree—A tree that produces nutlike fruits such as acorns, beechnuts, hickory nuts, seeds of certain pines, cherries, apples, samaras. Hard mast include acorns, beechnuts, and hickory nuts. Soft mast include cherries, apples, and samaras (on maple and ash trees). Mast trees are an important food source for wildlife.

matrix—The matrix is the dominant landscape element on a landscape in which smaller differentiated elements (patches) are embedded. It is commonly highly connected throughout the landscape.

mature tree—A tree that has reached the age where its growth declines or decay begins to increase. Also, a tree is mature when the benefits begin to decline, as in its ability to produce mast or the value of its wood.

merchantable diameter—The average stand diameter (arithmetic mean) of the merchantable-sized trees (> 5.5 inch diameter at breast height) in a stand. See average diameter for more information.

medial diameter—The average of the diameter or size-class midpoints of a stand, weighted by the proportion of basal area in each size class or diameter. Approximately the same as the

diameter at the midpoint of the basal area distribution. Medial diameter is favored by some (over both simple average and quadratic mean diameters) because it better reflects the size of the crop trees and is less influenced by small understory trees. See average diameter for more information.

mortality—The death of trees. In forests, it is a normal process that occurs when trees are old, crowded, or when they have been severely damaged by some agent. Mortality of some trees offer benefits to remaining trees and to wildlife. However, extensive mortality in a forest interferes with its expected development and desired uses.

native plant—A species that naturally occurs in a given location where its requirement for light, warmth, moisture, shelter, and nutrients are met.

natural forces—The factors that influence the development of a forest, including the soil, climate, and damaging agents.

NED—A computerized decision support model developed by the U.S. Forest Service for forest managers to provide assistance on integrated resource management. NED is a tool to incorporate wildlife habitats, visual and scenic qualities, wood production, water quality and quantity, and ecological aspects in forest planning and development of silvicultural treatments. In early versions of the software, including NED/SIPS and NED-1, the NED acronym was rooted in the concept of a "Northeastern Decision Model." As the geographic scope as well as our set of collaborators expanded, the name has remained but with expanded applicability that includes the temperate forest zone of the eastern United States.

NED/SIPS—NED/SIPS was the initial product of the development of NED. The computer program, subtitled Stand Inventory Processor and Simulator (SIPS), provided an effective means of creating, managing, and analyzing forest inventory records at the stand level. Its user-friendly interface relieved the pain of entering and editing stand inventory data, and once data are entered, a host of analytical tools were available to help understand the data. A variety of reports could be generated describing the vegetation structure, timber value, and economics of the stand. The user could apply any of a set of standard treatments to the stand or design a customized cutting scheme, and utilize one of the four incorporated stand growth simulators to show what the stand may look like in the future. Major SIPS features included access to four growth and yield simulators using the same data file format (NE TWIGS, SILVAH, OAKSIM, and FIBER), overstory summary tables for common measures of stand characteristics (i.e., density, species composition, volume, etc.), and economic analyses of incomes and expenses over the planning horizon.

net present value—The gross value minus costs at one point in time, generally the present.

non-commercial treatment—Any activity that does not produce at least enough value to cover the direct costs of that treatments.

nonpoint source pollution—Pollution that stems from a source that is spread out over the land. Nonpoint sources include runoff from silvicultural treatments, agricultural activities, waste water management and some construction activities. The actual pollutants may vary considerably.

nutrient—Elements, and other chemical substances, that enhance biological activity. Nitrogen, phosphorus, potassium, and sulfur are some of the nutrients necessary for plants to grow.

old growth—A forest community that is very old, generally with several age classes older than 80 years.

outbreak—Unusually large populations of insects or diseases that cause damage. Outbreaks vary in size, frequency and duration depending on the particular insect or disease and environmental conditions.

overland flow—The portion of rain or snowmelt that flows over the surface until it reaches a stream channel. It is not absorbed by the soil. Overland flow in forests is rare unless leaf litter and organic horizons of the soil have been severely disturbed or mineral soils have been compacted.

overmature—A stage in a tree's life when it has declined in vigor and is no longer growing due to old age.

overtopped—A condition or position where a tree's crown is completely covered by the crowns of one or more of its neighboring trees. An overtopped tree's crown is entirely below the general level of the canopy and does not receive any direct sunlight either from above or from the sides.

patch—A patch is a relatively homogeneous area that differs in some way from its surroundings (e.g., woodlot in a corn field, conifer plantation in a mixed-deciduous forest).

peak water flow—The instantaneous maximum flow of water, often occurring as the result of an intense storm, snowmelt, or a combination of both.

pest suppression program—A collection of methods used by forest managers to control outbreaks of damaging insects and diseases. These methods usually involve aerial spraying of pesticides or biological materials to reduce pest populations and minimize damage to the forest resources.

photosynthesis—The formation of starches and other carbohydrates from carbon dioxide, water, and sunlight in cells containing chlorophyll, or green colored cells in plants.

plantation—A forest stand in which most trees are planted or established from seed sown by people. Typically, planted trees are in rows, with equal spacing between each tree in a row and between rows.

pole—A tree, usually young, that is larger than 4 inches diameter at breast height (dbh) and smaller than 8 to 11 inches dbh.

pollutant—A resource out of place.

prescribed burn—The application of fire in forested or other areas, usually under specific conditions of weather and fuel moisture, to control vegetation for silvicultural purposes or to reduce hazards.

prescription—The specific instructions for controlled applications of silvicultural treatments based on information about the stands to which they apply.

province—Provinces cover areas on the order of tens of thousands of square miles. Provinces are characterized by broad vegetation regions and soil orders, which conform to climatic subzones controlled primarily by continental weather patterns such as length of dry season and duration of cold temperatures. The climatic subzones are extensive areas of similar potential natural communities as mapped by Kuchler (1964).

q-factor—Also called q-ratio. Represents a geometric progression of increasing numbers of trees with decreasing diameters (Smith 1986). For example, using 2-inch diameter classes, if the q-ratio is 1.2, the number of trees in the 6-inch diameter class will be 1.2 times the number of trees in the 8-inch diameter class.

quadratic mean diameter—The average stand diameter based on the tree of (arithmetic) mean basal area for all stems > 1 inch diameter at breast height (dbh). Weighted upward by the contribution of trees of larger dbh. Has historical significance because foresters were interested in the tree of "average volume" (arithmetic mean volume per tree). If a forester knew what the average tree volume was, then they could count the number of trees in a stand, and multiply that number by the average tree volume to compute stand volume. According to Curtis and Marshall (2000), in regular even-age stands the average volume per tree is closely related to the average basal area per tree, which is the same as the quadratic mean diameter. Stocking charts also use quadratic mean diameter because of the direct relationship between number of trees, basal area, and quadratic mean diameter. See average diameter for more information.

quarantine regulation—Federal, state and local laws that restrict the movement of plants or their products that may contain or promote damaging insects and diseases. These restrictions are intended to limit the spread of pests outside their current range.

regeneration—The seedlings and/or saplings in a new forest stand or age class. Natural regeneration originated from seeds, sprouts, or root suckers.

regeneration method—A cutting method by which a new age class is created. These methods include clearcutting, seed tree, shelterwood, single-tree selection, and group selection; also called reproduction method.

regeneration cuttings—Silvicultural cuttings designed to naturally regenerate the stand by providing for seedling (or vegetative stems) establishment or development, or both. Two even-age techniques; clearcutting and shelterwood, and two uneven-age techniques; single-tree selection and group selection.

relative abundance—The amount (abundance) of a given species, using any kind of measure, divided by the total abundance of all species. The sum of all species' relative abundances must equal unity (1.0). Relative abundance can also be expressed as a percentage, in which the total relative abundance of all species adds up to 100. If basal area is the measure of abundance, relative abundance is often termed "relative dominance" and is calculated by dividing the total basal area of a species by the total basal area of all species. The relative number of stems is another measure, commonly referred to as "relative density" among ecologists. In the practice of forestry, a separate concept of relative density has evolved. See "relative density" for further information.

relative density—An index of crowding for forest stands, also called the tree-area ratio; a measure of the absolute stand density expressed as a ratio to the density of some reference level. The reference level is usually the stand density of a fully stocked stand for a particular species composition, site, and method of treatment.

residual spacing—The distance between trees that remain in the forest after a silvicultural treatment.

resting cover—The cover used when animals are roosting or sleeping.

riparian area—The area where the transition between streams, or other bodies of water, and forest vegetation occurs. Riparian areas usually have unique plants, animals, and soil characteristics. The boundaries of riparian areas are not always clearly defined. Riparian areas require special care to protect the quality and habitats of streams.

roost—To sit, rest, or sleep on a pole, tree, or protected place on the ground. Roosting is a term used mostly in reference to birds.

rotation—The planned interval of time between treatments that regenerate a stand.

runoff—Surface streamflow leaving a watershed. Sources of runoff are precipitation falling in the channel, overland flow (rare in forested areas), and subsurface water exiting from soils and bedrock. In this guide, runoff is synonymous with streamflow.

sapling—A tree, usually young, that is larger than a seedling but smaller than a pole-sized tree. Size varies by region, but a sapling is usually taller than 6 feet and between 1 and 4 inches in diameter at breast height.

sawlog—A log suitable in size and quality to be milled in to lumber of any size. Usually sawlogs are at least 8 inches in diameter after the bark is removed.

sawtimber—Trees large enough to be cut into sawlogs.

scale—A reference to the relative size of things. Or, size in comparison with its environment, a human figure, or the landscape. The human scale, or the size of people, is a standard reference for the size of all things in our culture.

scenic quality—The positive and negative visual characteristics of the natural landscape.

section—Sections are broad areas of similar geomorphic processes, stratigraphy, geologic origin, drainage networks, topography, and regional climate. Sections cover areas on the order of thousands of square miles; also used to denote a portion of a township in a public land survey, where an individual section measures one mile on a side (80 chains), forming a square, equaling approximately 1 square mile or 640 acres.

sedimentation—The accumulation of organic and mineral soil particles and rocks in streams and water bodies due to erosion. Sedimentation often accompanies flooding. The application of Best Management Practices will usually protect against sedimentation during and after treatments.

seed tree—A tree that produces seed. Seed trees are usually mature and high in quality.

seedling—A tree grown from a seed. Usually the term is restricted to trees smaller than saplings, or less than 6 feet tall or smaller than 1 inch diameter at breast height.

semi-woody plant—Plants with stems that reach nearly full size and become somewhat woody in one growing season; subshrubs. They commonly grow additional shoots but not additional layers of wood in following years. Such stems normally live only a few years, and are replaced by new stems growing from a persistent root system. These include brambles.

shade intolerance—The relative inability of a plant to become established and grow in the shade.

shade tolerance—The relative capacity of a plant to become established and grow in the shade.

shelterwood—An even-age silvicultural technique involving the removal of the understory and lower crown canopy trees to allow the new stand to regenerate under shade. Subsequent removal of the overstory in one or several cuts.

silvicultural system—A planned process whereby a stand is tended, and re-established. The system's name is based on the number of age classes (for example even-age or two-age), and/or the regeneration method used (for example, shelterwood, crop-tree, or selection).

silvicultural treatment—A process or action that can be applied in a controlled manor according to the requirements of a prescription or plan to a forest community to improve real or potential benefits.

silviculture—The art, science, and practice of establishing, tending, and reproducing forest stands with desired characteristics.

single-tree selection—An uneven-agesilvicultural technique involving the removal of trees singly or in groups of 2 or 3, which maintains a continuous canopy and an uneven-age or uneven-sized mixture.

site—The combination of biotic, climatic, topographic, and soil conditions of an area; the environment at a location.

site conditions—The site conditions representative of a stand are sometimes designated by soil factors (parent material, texture, drainage, or soil series), or by direct measurements such as site index—the height of the dominant/codominant trees at a base age of usually 50 years.

skid trail—A path or minor road in the woods that is followed when skidding logs from the stump to the landing.

skidding—The act of moving felled logs from their stumps to a landing by dragging or sliding.

slash—Branches, twigs, and leaves of trees left on the ground after a treatment.

snag—A standing dead tree without branches, or the standing portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

softwoods— A term describing both the wood and the trees themselves that in most cases have needles or scale-like leaves (the conifers); gymnosperms.

soil properties—The combination of chemical and physical factors which influence the movement of moisture into, through, and out of soils. Examples include infiltration capacity, porosity, bulk density, soil depth, and water-holding capacity.

soil water—Water held between soil mineral and organic particles. This water is susceptible to evaporation, plant uptake, lateral flow into streams, and downward flow into groundwater.

species composition—The collection of plant species found in an area. Composition is expressed as a cover type, or a percentage of either the total number, the density, or volume of all species in that area.

species diversity—The number of different plants and animals, and other life forms, coexisting in a community.

species richness—The number of different species present in an area.

stand—An area of trees of a certain species composition (cover type), age class or size class distribution and condition (quality, vigor, risk), usually growing on a fairly homogeneous site. The trees are sufficiently uniform in spacing, condition, age arrangement and/or forest type to be distinguished from neighboring stands. The conditions of the site are relatively uniform, including soil properties, water drainage, slope, exposure to weather, and productivity. Stands of 5 acres and larger commonly are recognized, though minimum stand size depends upon size of ownership and intensity of management.

stand composition—The collection of plants, particularly trees, that are found in a stand.

stand condition—The number, size, species, quality, and vigor of trees in a forest stand.

stand density—A quantitative measure of the proportion of area in a stand actually occupied by trees. This is an absolute measure rather than a relative measure, or percentage.

stand structure—The arrangement of trees of different sizes and ages in a stand.

stewardship—The wise management and use of forest resources to ensure their health and productivity for the future with regard for generations to come.

stocking—A subjective indication of the number of trees present on a stand compared to the optimum number for your desired outcomes expressed as a percentage.

stream flow—Flowing surface water formed by a combination of precipitation intercepted by the stream channel, and moisture passing over or through soils and bedrock. Stream flow is generally confined to a well defined channel, except during flooding or in exceptionally flat topography.

stream warming—The heating of stream water by sunlight. The forest canopy covering streams can be managed to either protect against or encourage stream warming.

succession—A gradual and continuous replacement of one kind of plant and animal community by a more complex community. The environment is modified by the life activities of the plants and animals present thereby making it unfavorable for themselves. They are gradually replaced by a different group of plants and animals better adapted to the new environment.

sustainable—The indefinite and steady supply of something.

terrestrial—Of or pertaining to the land as distinct from air or water.

territory—A defended area in the home range of an animal, particularly during the breeding season.

thinning—The removal of some trees to improve and enhance the vigor and growth of other trees. Thinning enhances forest health and allows you to recover any excess of potential mortality.

thinning interval—The period of time between successive thinning treatments, usually used in connection with even-age stands.

threatened and endangered species—Plant or animal species with limited abundance and distribution and in danger of disappearing due to lack of suitable habitat and/or other factors.

travel cover—The cover that allows animals to move from one area to another without being detected.

understory—The small trees, shrubs, and other vegetation growing beneath the canopy of forest trees and above the herbaceous plants on the forest floor.

uneven-age stand—A stand with trees in three or more distinct age classes, either intermixed or in small groups, growing on a uniform site; a stand containing trees of several 20-year age-classes. These stands generally contain trees of many sizes (seedling through sawtimber) due to the range in age as well as differences in growth rate among species.

uneven-age system—A planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes.

veneer—A thin sheet of wood of uniform thickness, produced by rotary cutting, slicing or sawing.

vertical diversity—The extent to which plants are layered within an area. The degree of layering is determined by three factors: 1) the arrangement of different growth forms (trees, shrubs, vines, herbs, mosses and lichens); 2) the distribution of different tree and shrub species having different heights and crown characteristics; and 3) the number of trees of different ages.

virus—Microorganisms that are not able to produce their own food. They obtain nutrients from other living or dead organisms. The study of tree viruses is relatively new, but several have been identified. They infect leaves or roots, and may contribute to tree death.

visual and scenic qualities—A category of aesthetic factors associated with forests that includes qualities like big tree appearance, plants with special characteristics, permanent openings, and concern for the visual effects of disturbance and slash after treatments.

visual quality—The positive and negative visual characteristics of anything you see.

warm-water fish—Fish are tolerant of high water temperatures often found in larger bodies of water, such as rivers and lakes. An example is large-mouth bass.

water quality and quantity—A category of factors associated with forests that includes intensive protection of water quality, riparian areas, wetlands, and fisheries; and the amount of water that flows from the forest.

water yield—The distribution and total quantity of runoff, usually considered over some specified period of time. Water yield may be characterized by total volume of runoff and flow duration curves.

watershed—An area of land through which precipitation is redistributed into components of the hydrologic cycle, including evaporation, groundwater, and streamflow. A watershed is all the land giving rise to streamflow at a selected point in a stream channel; the area drained by a river or stream and its tributaries.

wetland—In the absence of a single, universally recognized definition, a wetland is a land/water ecosystem characterized by periodic inundation. The soils developed under the influence of saturation. It supports plants and animals adapted to these conditions.

wildlife cover—Hiding places that provide animals with protection from weather, predators, or other dangers. Specialized types of cover include breeding cover, escape cover, resting cover, and travel cover.

wildlife habitat—The combination of environmental factors, such as food, water, cover, and their spatial distribution that a given species needs to survive and reproduce in a given area. Each species has unique habitat requirements.

wildlife pest—Animals that cause excessive damage to trees by eating leaves, twigs, buds, bark, or roots.

woody debris—The larger woody branch and stem wood (greater than 1 inch in diameter) that has fallen either naturally or as a result of logging. Woody debris in water is an important layer for aquatic organisms and a source of shelter for fish.

woody plants—Plant species with persistent stems capable of growing an additional sheath, or layer, of wood and bark each year for the life of the plant. These include trees, shrubs, and woody vines (grapevines).

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This is the reference guide for NED-2, which is the latest version of NED, a forest ecosystem management decision support system. This software is part of a family of software products intended to help resource managers develop goals, assess current and future conditions, and produce sustainable management plans for forest properties. Designed for stand-alone Windows-based personal computers, NED-2 integrates a variety of forest management tools into a single environment. These tools include databases, growth and yield models, wildlife models, geographic information systems (GIS), visualization tools, and others. The software is distributed with an online help system and a user's guide. This reference guide provides more detailed explanations of the models, equations, and rules that underlie the software. NED-2 software can be downloaded from http://www.nrs.fs.fed.us/tools/ned/products/ned2/

KEY WORDS: decision support, forest management, software, silviculture, multiple benefits, eastern North America

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